Instructions for Entrance Application

Doctoral Program

Department of Advanced Interdisciplinary Studies

Graduate School of Engineering
The University of Tokyo
Academic Year 2020

Table of Contents

1. Overview

These instructions supplement the "Guidelines for Applicants to the 2020 Doctoral Program, Graduate School of Engineering, the University of Tokyo (Guidelines)" and explain provisions specific to the Department of Advanced Interdisciplinary Studies. Applicants should first read the Guidelines as they contain important information including qualifications required for application and application procedures common to all research programs. Please note that the application period is divided into **Application Period A** and **B** and that application to the General Course and to the Advanced Science and Technology Innovator Development Course is possible during both periods.

The Department of Advanced Interdisciplinary Studies provides education and research training related to budding and pioneering basic and applied research in various areas of advanced science and technology. It also provides guidance in what is called "research on research" in these areas. In addition to traditional graduate school education, it provides mid-career individuals with the opportunity to resume their studies in an academic environment. It aims to nurture not only talented, creative researchers in various areas of advanced science and technology but also progressive, international research experts and corporate managers with a broad vision as well as visionary, interdisciplinary policy makers.

Inquiries

Please address inquiries to

The Office of Educational and Research Support
Research Center for Advanced Science and Technology
The University of Tokyo
4-6-1 Komaba, Meguro-ku, Tokyo 153-8904, JAPAN
Tel +81-3-5452-5385 Fax +81-3-5452-5398
https://www.ais.rcast.u-tokyo.ac.jp/en/educationresearch/

2. Application Procedure (General Course)

(1) Eligibility requirement: Master's degree or equivalent

Individuals without a master's degree from an accredited university should contact the Postgraduate Section, Office of Graduate School of Engineering, The University of Tokyo.

(2) Entrance periods

Application Period A: September 2019 or April 2020

Application Period B: April 2020

(3) Admission quota: 46 (including the General Course and Advanced Science and Technology Innovator Development Course)

(4) Graduate degree conferred: Doctor of Philosophy or Doctor of Engineering

(5) Research and thesis advisor:

Students admitted to the graduate program for Advanced Interdisciplinary Studies carry out research under the guidance of a designated faculty member who serves as the student's research and thesis advisor. Applicants must identify a faculty member with whom they propose to conduct their research and then contact the faculty member to arrange an interview in which the applicant describes his or her academic achievements, research experience, research abilities, and research plans **before submitting the application form**. The applicant may designate a second preference for an advisor. The applicant should arrange an interview with that person as well.

The faculty members available to serve as an advisor are listed in Section 4 of the instructions, "Research Topics and Faculty Members in Department of Advanced Interdisciplinary Studies, Graduate School of Engineering".

For those who would like to apply for either course, enter the name of the faculty member(s) and the date(s) of the interview(s) in the appropriate section of the "Information Sheet for Applicants".

- Interviews with all potential advisors need to be conducted between February 15 and July 1 in Application Period A, September 6 and November 18 in Application Period B.

Applicants may not be allowed to take the oral examination if they fail to complete this procedure.

(6) Entrance examination

English proficiency:

Unless the applicant obtained or expects to obtain a master's degree from the Graduate School at The University of Tokyo, the applicant must submit a TOEFL score obtained after September 2017 if applying during Application Period A and after February 2018 if applying during Application Period B.

1. A copy of the TOEFL Examinee Score Report provided by the Educational Testing Service (ETS) must be submitted. It is the sole responsibility of the applicant to ensure that the University receives this report from the ETS.
2. For Application Period A, if the applicant cannot send a score report so that it is received by 5:00 pm on July 16, the applicant can still take the TOEFL (ITP, Institutional Testing Program) hosted by the Graduate School of Engineering at The University of Tokyo on Monday, August 26.
3. For Application Period B, however, if the applicant cannot send a score report so that it is received by 5:00 pm on January 14, the application may be rejected as there will be no TOEFL (ITP) during this application period, and the applicant may not be able to take the oral examination.

Oral examination:

The applicant's research achievements since graduation from undergraduate school (or since completing undergraduate studies) are evaluated on the basis of a 12-minute presentation by the applicant on his or her previous research and on future research plans and of a subsequent oral examination. The presentation should be based on materials submitted prior to the examination. (A projector may be used.) Detailed instructions for making the presentation can be obtained by contacting your proposed advisor.

- A projector can be used for the presentation. The applicant is responsible for setting up the necessary equipment.

Schedule and procedure for oral examinations

Dates Application Period A: Application Period B:	Monday, August 26 – Thursday, August 29, 2019 Monday, January 20 – Thursday, January 23, 2020 Note: The applicant will be notified of the date by postal mail. (The examination admission card will be mailed separately.) If the candidate does not receive notification by one week before the first examination day, he or she should contact the Office of Research Cooperation.
Location	Research Center for Advanced Science and Technology, Building 13 The University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo
Items to bring for the examination	In addition to the examination application card, the applicant should bring materials illustrating and presenting his or her research work, such as master's thesis and major research papers, and the design of proposed research.
Arrival time	The applicant must arrive at the waiting room designated for oral examinations at least 15 minutes before his or her scheduled time. Applicants arriving later than their scheduled time should report to the examination supervisor.

(7) Documents to be submitted:

Along with the application form and the materials specified in item 7 of the Guidelines, the applicant should submit the following materials to the Office of the Graduate School of Engineering, The University of Tokyo.

A. A copy of the TOEFL Examinee Score Report provided by the Educational Testing Service (ETS). The ETS should be instructed to send the report directly to the Graduate School of Engineering, the University of Tokyo. The Designated Institution (DI) code for the Graduate School of Engineering at The University of Tokyo is "8596". It is the sole responsibility of the applicant to ensure that the University of Tokyo receives the applicant's score report from the ETS.

B. Applicants Applicant Information Sheet
(Download and use the format found on the department web site.)

C. A report (in Japanese or English) on the applicant's research achievements. It should summarize the applicant's research from the completion of undergraduate studies to the present. Including figures and tables, the material should not exceed four A4 (or letter) sheets.

D. An A4 (or letter) size list of research papers in Japanese or English arranged in the order of 1) papers published in academic journals, 2) overview/review articles, 3) oral presentations, and 4) other

E. Research plans (in Japanese or English) described on two to four A4 (or letter) sheets

(8) Others

For applicants following Schedule A who expect to obtain a master's degree later than October 2019, the second examination (master thesis review) will be conducted in late January or February 2020. Successful applicants will be notified of their examination schedule.

3. Application Procedure (Advanced Science and Technology Innovator Development Course)

The Advanced Science and Technology Innovator Development Course for mature students was founded in the Department of Advanced Interdisciplinary Studies in the 2009 academic year.

(1) Eligibility requirement: Master's degree or equivalent

Individuals without a master's degree from an accredited university should contact the Postgraduate Section, Office of Graduate School of Engineering, The University of Tokyo.

(2) Entrance periods

Application Period A: September 2019 or April 2020

Application Period B: April 2020

(3) Admission quota: 46 (including the General Course and Advanced Science and Technology Innovator Development Course)

(4) Graduate degree conferred: Doctor of Philosophy or Doctor of Engineering

(5) Research and thesis advisor:

Students admitted to the graduate program for Advanced Interdisciplinary Studies carry out research under the guidance of a designated faculty member who serves as the student's research and thesis advisor. Applicants must identify a faculty member with whom they propose to conduct their research and then contact the faculty member to arrange an interview in which the applicant describes his or her academic achievements, research experience, research abilities, and research plans **before submitting the application form**. The applicant may designate a second preference for an advisor. The applicant should arrange an interview with that person as well.

The faculty members available to serve as an advisor are listed in Section 4 of these instructions, "Research Topics and Faculty Members in Department of Advanced Interdisciplinary Studies, Graduate School of Engineering".

For those who would like to apply for either course, enter the name of the faculty member(s) and the date(s) of the interview(s) in the appropriate section of the "Information Sheet for Applicants".

- Interviews with all potential advisors need to be conducted between February 15 and July 1 in Application Period A, September 6 and November 18 in Application Period B

Applicants may not be allowed to take the oral examination if they fail to complete this procedure.

(6) Entrance examination

English proficiency:

Unless the applicant obtained or expects to obtain a master's degree from the Graduate School at the University of Tokyo, the applicant must submit a score of TOEIC Listening & Reading test obtained after September 2017 if applying during Application Period A and after February 2018 if applying during Application Period B (scores of IP tests are not accepted).

- For Application Period A, if the applicant cannot send a score report so that it is received by 5:00 pm on July 16, the application will be rejected, and the applicant will not be able to take the oral examination. For Application Period B, if the applicant cannot send a score report so that it is received by 5:00 pm on January 14, the application may be rejected, and the applicant may not be able to take the oral examination.

Oral examination:

The applicant's research achievements since graduation from undergraduate school (or since completing undergraduate studies) are evaluated on the basis of a 12-minute presentation by the applicant on his or her previous research and on future research plans and of a subsequent oral examination. The presentation should be based on materials submitted prior to the examination. (A projector may be used.) Detailed instructions for making the presentation can be obtained by contacting your proposed advisor.

- A projector can be used for the presentation. The applicant is responsible for setting up the necessary equipment.

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Arrival time	The applicant must arrive at the waiting room designated for oral examinations at least 15 minutes before his or her scheduled time. Applicants arriving later than their scheduled time should report to the examination supervisor.

(7) Documents to be submitted:

Along with the application form and the materials specified in item 7 of the Instructions, the applicant should submit the following materials to the Office of the Graduate School of Engineering, The University of Tokyo.

A. A copy of the Examinee's Score Record provided by The Institute for International Business Communication (IIBC). Applicants who have already obtained or expect to obtain a master's degree from the Graduate School at the University of Tokyo are exempt from this requirement.

B. Applicant Information Sheet
(Download and use the format found on the department web site.)

C. A report (in Japanese or English) on the applicant's research achievements. It should summarize the applicant's research from the completion of undergraduate studies to the present. Including figures and tables, the material should not exceed four A4 (or letter) sheets.

D. An A4 (or letter) size list of research papers in Japanese or English arranged in the order of 1) papers published in academic journals, 2) overview/review articles, 3) oral presentations, and 4) other

E. Research plans (in Japanese or English) described on two to four A4 (or letter) sheets

(8) Others

For applicants following Schedule A who expect to obtain a master's degree later than October 2019, the second examination (master thesis review) will be conducted in late January or February 2020. Successful applicants will be notified of their examination schedule.

4. Research Topics and Faculty Members in Department of Advanced Interdisciplinary Studies, Graduate School of Engineering

Fields of study	Contents	Faculty
Graduate School		
Artificial Intelligence	Research interest of Intelligent System Group is to mine useful information using enormous data acquired from various sources, which is abstracted to be knowledge fruitful to human beings and social systems. 1. Intelligent and autonomous system, such as robots and artificial satellites, is essential to future infrastructure. Based on the artificial intelligence technology including machine learning and probabilistic reasoning, the methodology to detect abnormal events and anomalies from hyper-dimensional sensor data. Intelligent autonomous mobile robots that estimate state of environment and localize themselves using various sensor data. 2. Processing of huge amounts of data obtained by earth remote sensing satellites and planetary surveyors is an important task for us. State estimation of satellites and observation sensors leads to a high-accuracy geometric and radiometric data processing. Methodology to support remote sensing, such as construction of three-dimensional maps and feature detection, is studied. An optical system with intelligence realizes a re-configurable sensor that provides optimum performance of hardware.	Prof. YAIRI, Takehisa Prof. IWASAKI, Akira
Science & Technology Studies Science & Technology Policy	The objective of the 'Science and Technology Policy' field is to draw concrete policy implications, based on inter-disciplinary studies over economics, managerial engineering and political science, on current government S&T policies in Japan. S&T policies cover a wide range of policy initiatives to promote firm's innovation activities, which include not only direct financial incentives such as R&D subsidies and tax breaks, but also university industry linkage promotion, intellectual property right policy and financial arrangements for encouraging entrepreneurship. It is possible to focus on one specific policy instrument or field for research theme. Or, one can address also more broad issues such as systemic problems of Japan's national innovation system. In a course work, a focus is put on empirical studies, based on sound methodology and data directly addressing the research theme in order to come up with concrete policy recommendations. Please refer to http://www.mo.rcast.u-tokyo.ac.jp/ for further information on research topics of this field.	Prof. MOTOHASHI, Kazuyuki

Fields of study	Contents	Faculty
	Science and Technology Studies aim at investigating the internal development of science and technology as well as their complex external relationship with society, based on case studies in specific periods and areas. We, primarily from the historical perspective, investigate the development of science and technology in Japan, Europe, and the U.S., and their relationship to economy, society, and culture. On the basis of such historical investigation, we will further pursue the relationship between science, technology, and society from wider perspective.	Prof. HASHIMOTO, Takehiko
Advanced Research Strategy and Social Systems		
"barrier-free" studies (accessibility)	There are different kinds of barriers in life, facing disabled people and senior people in our contemporary society. These barriers include physical barriers that have to do with housing and roads, information and cultural barriers which relate to access to information, psychological barriers with awareness of people, and the legal and institutional barriers embedded in the social systems. Clarifying the realities of these barriers, our program systemically analyzes different factors including the mechanisms that give rise to barriers, the relationships among barriers, and their ideological backgrounds, in order to eradicate these barriers. The priority is given to the perspective of disabled people and their lived experiences as the basis of research.	Prof. FUKUSHIMA, Satoshi
Tojisha kenkyu	The term tojisha kenkyu consists of two Japanese words: tojisha and kenkyu. Tojisha(s) refers to "interested person(s)," such as disabled persons or patients. Kenkyu means "study." Therefore, tojisha kenkyu literally translates as "study by interested persons themselves." It refers to a unique activity of self-study by persons with mental health problems or other problems in which they study their hardship ("symptoms" and everyday worries) with their peers. It started among people with schizophrenia and gradually spread among individuals with a range of conditions—addiction, cerebral palsy, and developmental disorders. We focus on three aspects of tojisha-kenkyu: abduction and testing, group facilitation methods and restorative effects. To put it more concretely, our research topics are as follows: 1. Hypothesis generation through tojisha kenkyu and its testing. 2. Conversation analysis and natural linguistic processing of narratives produced in tojisha kenkyu. 3. Clinical effectiveness research on tojisha kenkyu.	Assoc. Prof. KUMAGAYA, Shin-ichiro
Assistive Technology	The purpose of this project is to study innovative and new social and special educational systems that using advanced technology. We intend to focus on the application of existing technology rather than development of new technology. Also, we emphasize not only assistive technology but also environmental accommodation rather than rehabilitation training. Present research themes are as follows: (1) Technological support for children with learning disabilities (2) Support for employment using information and communication technologies (3) Improvements in logical thinking by using digital pen based electronic white boards (4) The further development of our assistive technology database (5) The effects of technology in improving competence in both education and society	Prof. NAKAMURA, Kenryu Assoc. Prof. KONDO, Takeo Lecturer TAKAHASHI, Maiko
Technology Management	1.Research relating to corporate intellectual property management. We are performing empirical analysis and case analysis with the ultimate aim of pioneering research of intellectual property management. 2.Research relating to quality and evaluation of technology and intellectual properties. While performing empirical research on the topics of economic value of technology and legal value estimate of patents,we are also compiling proposals for practical evaluation tools. Looking forward to value estimates of patents for the 2008 fiscal year,we plan to participate in a joint international research project that aims to compare value estimates in Japan,the USA and Europe,all of which operate under different patenting systems. 3.Research relating to intellectual property management in academic-industrial collaboration and technology transfers. We are currently performing research on the topic of intellectual property management for academic-industrial collaboration,through research into factors such as the effect of universities' intellectual property management on	Prof. WATANABE, Toshiya (New students for academic year 2020will not be accepted)

Fields of study	Contents	Faculty
	collaborative research and effective intellectual property management methods devised from the evaluation of license technology transfer mechanisms. 4.Research relating to the education and training of personnel in the field of intellectual property. We are currently studying training methods for intellectual property personnel through programs offering adult education based on the executive school method.	
Macroeconomic Analysis	The objective of macroeconomics is to understand the mechanism of economic growth and business cycles observed in aggregate economic data and to derive the policy implication on improving the nation's welfare and achieving the goal of the optimal resource allocation. We develop time-series econometric methods to identify the relative role of the production technology and policy shifts in generating business cycles. We also evaluate the methods of estimating the dynamic stochastic general equilibrium model and conduct empirical analysis based on estimated models.	Prof. SHINTANI, Mototsugu
Political and Administrative system analysis	We focus on the analysis of contemporary Japanese Political History in the postwar era. Our method is based on political history, public administration and public policy. In our project, we stress the importance of oral history method and several oral history projects are conducted every year. Our research interests are as below: 1 Contemporary Japanese Political History 2 Comparative Public Policy 3 Functional Analysis of Governmental Bureaucracy in Modern Society 4 Oral History	Prof. MAKIHARA, Izuru
Religion and Global Security	Issues related to global security is comprehensively covered. Broader topics on religion and politics, including the role that religion plays in the formation of identity, religion's influence on individual motivation to action, mobilization of social groups, the effect that religion has on nation-building and state formation are covered. Historical, theoretical and comparative researches related to themes of religion in international relations including the relationship between religion and social norms, religious violence and terrorism are focus of analysis are conducted.	Prof. IKEUCHI,Satoshi
Advanced Materials and Devices		
Quantum Information Physics & Engineering	Quantum information science is a newly emerging interdisciplinary research field aiming at application of fundamental principles of quantum mechanics to novel information processing, communication, and precision measurement. We investigate physics and engineering of quantum state manipulation and measurement in nano-scale electrical and optical devices. The research topics includes (i)integrated superconducting qubits and quantum computing, (ii) microwave quantum optics in superconducting quantum circuits, (iii) hybrid quantum system as an interface between different types of quantum systems.	Prof. NAKAMURA, Yasunobu Assoc. Prof. USAMI ,Koji
High Performance Materials	We have been working on optical properties of compound/perovskite semiconductors and their applications to photonic/photovoltaic devices. In particular, we are focusing on semiconductor-based wavelength-conversion materials/devices and newly emerging perovskite solar cells. Research topics include i) sublattice-reversal epitaxy of III-V compound semiconductors, ii) high performance wavelength-conversion devices, iii) fabrication of metal-halide perovskite thin films, iv) basic properties of metal-halide perovskite-type semiconductors, and v) perovskite solar cells and photonic devices.	Prof. KONDO, Takashi
	Mechanical property and performance of materials are strongly influenced by their microstructure especially at their most basic structural and functional length scales. Prof. Inoue's research interests include experimental characterization and analysis of defects, deformation and fracture in structural metals and alloys, and metal-metal and metal-matrix composites. Current research activities focus primarily on the local deformation behavior of novel high-strength steels, high-resolution strain measurement method, and development of materials integration systems.	Assoc. Prof. INOUE,Junya Assoc. Prof. WATAMABE, Makoto

Fields of study	Contents	Faculty
Micro Device Engineering	Research interests include integrated MEMS (Micro Electro Mechanical Systems) based on the semiconductor silicon micromachining processes. Recent research topics are: (1) Semiconductor micromachining, MEMS process, (2) Microactuators for optical applications (communication, display, measurement), (3) Energy harvesters for IoT applications (4) Biochemical instruments based on thin-film-transistors	Prof. TOSHIYOSHI,Hiroshi Assoc. Prof. Tixier-MITA, Agnes
Quantum Microstructure Devices	We are investigating photonic nanostructures including photonic crystals for realizing novel control of light and are exploring light-matter interactions in those structures for various applications. We are also studying topological wave engineering aiming at exploration and utilization of the topological properties of classical waves such as light, elastic waves, and sounds. The main research topics are as follows. · Design and fabrication technology of photonic nanostructures · Control of light emission properties by using photonic nanostructure · Quantum optics and solid state cavity quantum electrodynamics based on photonic nanostructures · Control and application of angular momentum of light by photonic nanostructure · Topological photonics / phononics	Prof. IWAMOTO, Satoshi
Climate Change	We work on diagnostic and numerical modeling studies on the formation of individual components of the atmospheric general circulation and mechanisms and predictability of their natural variability and resultant extreme weather conditions, from a viewpoint of their interactions with the ocean, snow/ice and land surface processes. We also examine their natural variability and its long-term modulations under changing climatic conditions in the past, present and future.	Prof. NAKAMURA, Hisashi Assoc. Prof. KOSAKA, Yu
Energy and Environment	Organic, inorganic and hybrid materials are investigated for application to the next-generation solar cells. Our research targets include the followings: Perovskite solar cells / Dye-sensitized solar cells / Organic thin film solar cells / High efficiency hybrid solar cells / Spectral splitting tandem cells / Photo-rechargeable batteries	Prof. SEGAWA, Hiroshi
New energy	New semiconductor materials and novel quantum nanostructures are explored for application to next-generation high-efficiency photovoltaic solar energy conversion. Research topics include: (1) Development of novel thin-film III-V compound semiconductors for application to multijunction solar cells with efficiencies toward 50% (2) Self-organized epitaxial growth of 3-dimensional quantum nanostructures and superlattices (3) Fabrication and testing of high-efficiency multi-band solar cells and concentrator modules based on quantum nanostructures and novel materials (4) Thin-film flexible III-V solar cells fabricated using epitaxial lift-off technique (5) Nanoscale texturing technology of optical components leading to very low reflection losses (6) Syntheses of functional nanomaterials such as colloidal quantum dots (7) Development of solution-processed near and short-wavelength infrared solar cells	Prof. OKADA, Yoshitaka Project Prof. KUBO, Takaya Project Assoc. Prof. AHSAN, Nazmul
	Renewable energy systems play an important role as an energy infrastructure for a sustainable future society. In this course, for renewable energy (especially wind power generation, wave power generation, etc.), research on basic elemental technologies, power generation system research, and peripheral problem solving research will be themes, and optimum theoretical systematization for capturing energy, high efficiency While promoting research as a power generation system, in cooperation with regions and companies, we will carry out various research and development to properly implement renewable energy systems in society. (1) Optimum wind power generation system development by computational fluid dynamics (2) High efficiency cutting edge wind power system research and development (3) Environmental Symbiotic Wind Power Generation System Research and Development (4) Wind power generation smart maintenance technology research and development (5) Regional Symbiosis Renewable Energy System Research and Development (6) Natural symbiosis type blowhole wave power generation system development (7) Intelligent wind power system research using IoT, Big Data	Project Assoc. Prof. IIDA, Makoto

Fields of study	Contents	Faculty
Theoretical Chemistry	Proteins are composed of amino acid residues, and they function as catalyst, transporter, or sensor, etc. Our goal is understanding protein functions on the basis of the molecular structures.	Prof. ISHIKITA, Hiroshi Assoc.Prof. SAITO, Kesuke Project Assoc. Prof. TAMURA, Hiroyuki
Energy systems	Solar energy can take a majority of energy supply in our society if we can realize an energy system in which solar energy is stored in chemical substances in the regions with high irradiance and they are transported to the region of large energy demand. For such a system, it is promising to combine high efficiency photovoltaic (PV) power generation and electrochemical reactions to produce solar fuel, which is capable of long-term storage and transport. Our objective is to develop high efficiency PV cells and electrochemical reactors which are included in the system to produce “solar fuel.” The core competence is semiconductor nano-crystals. PV can be twice as efficient as conventional technology by implementing the epitaxial nanostructures of compound semiconductor crystals into the modules with sunlight concentration. Our laboratory develops all the relevant technologies from the growth of nano-crystals to system evaluation. Semiconductor crystals are also important as the active sites of electrochemical reactions. We aim at high-efficiency production of “solar fuel” by implementing an essential mechanism of natural photosynthesis into artificial crystals. The key exists at the interface between a semiconductor and a solution.	Prof. SUGIYAMA, Masakazu Project Assoc. Prof. MINEGISHI, Tsutomu
Advanced optical systems and materials	We are studying the advanced optical systems and interactions between light and matter. Presently, we are focusing on the full vector analysis of interference and diffraction and developing novel optical phenomena and materials relating to the amplitude, phase, and polarization. We are also studying the light-light interaction via optical materials. Especially, optical wave control with metal nano-structures and plasmonic effects.	Prof. Tsutomu, SHIMURA
Optoelectric Functional Thin Films	Using a new low temperature epitaxial growth technique, we are developing high performance GaN electron and optical devices which take advantages of its excellent properties.) Main research topics are listed below: 1. Development of high intensity blue and UV LEDs 2. Development of high efficiency power electronics 3. Development of large area GaN-LED displays 4. Development of organic-inorganic hybrid devices 5. Development of large area flexible electronics	Prof. FUJIOKA, Hiroshi
Advanced Information Systems		
Information Devices	Optical fiber communication technologies play a vital role as a pillar of the communication networks. We study the fiber-based devices and subsystems for applications in communication and sensing. Main research subjects are as follows. (1) Photonic devices based on carbon nanotube and graphene, and their applications (2) Short-pulse mode-locked fiber lasers and their applications (3) Fast wavelength-swept fiber lasers and their applications (4) Nonlinear fibers and their applications	Prof. YAMASHITA,Shinji Assoc.Prof. SET Sze Yun
	Optoelectronic devices are studied, including semiconductor lasers, light emitting diodes, photovoltaic cells, optical switches, and photonic integrated circuits, as well as their applications to energy and information/communication systems. Main subjects of current research are as follows: (1) metal-organic vapor phase epitaxy (MOVPE) and micro/nano fabrication technologies for group III nitride, InP, and GaAs based compound semiconductor quantum structures, (2) large scale and fast matrix optical switches, (3) monolithic lightwave synthesizer photonic integrated circuits, (4) micro-opto-electro-mechanical systems (MOEMS), (5) optical interconnect, (6) photonic networking, (7) compound semiconductor high efficiency solar cells, (8) solar fuel, (9) sustainable energy system based on sunlight.	Prof. NAKANO, Yoshiaki Assoc. Prof. TANEMURA, Takuo

Fields of study	Contents	Faculty
Cyber Physical System	We mainly address high-performance, dependable, and low-power computer system to realize advanced interaction between physical and cyber worlds. - IoT/Cyber-Physical System: Optimization of total computer systems by integrating sensors and server systems in IoT world. - Ultra Low Power Computer System: Ultra low power VLSI systems and high-performance and low-power computing through co-optimization between circuit technology, computer architecture, system software, and algorithm.	Prof. NAKAMURA, Hiroshi
Co-creative Community Planning, Design, and Management	Sustainable Community Design, Planning, and Management through Collaborative and Co-creative Approach are our research interests. Our current research topics includes: 1 Place based planning and management 2 Participatory and democratic design and planning 3 Smart community, In addition, water and environmental issues are of our research targets. 1 Water quality in natural water environment 2 Water supply systems in urban and rural areas 3 Water treatment technologies for safe water	Prof. KOIZUMI,Hideki Assoc. Prof. OGUMA, Kumiko Lecturer HASHIMOTO, Takashi
Intelligent Cooperative Systems	The aim of the research is to establish basic technologies for integrating the superior functions of the living organisms with mechanical systems, and for operating the animal behavior by artificially controlling the function of the brain systems from interdisciplinary approaches of informatics, engineering and biology. As models of the brain systems we use a cultured neuron system, microbrain system (insect brain) and the rat brain and apply the multi-scale analysis to these brain models from different levels such as the gene, neuron, neuron network, and behavioral level. The results are evaluated and integrated in a robot under real circumstances. Based on our understanding of the brain functions we investigate the bio-machine hybrid system, and also the artificial operation and modification of the animal behavior.	Prof. KANZAKI, Ryohei Assoc. Prof. TAKAHASHI, Hirokazu Project Lecturer NAMIKI, Shigehiro
	The “cybernetic interface” is an interface technology to tightly integrate humans and computers in order to realize advanced information processing. In our laboratory, various novel cybernetic interface technologies, including advanced “virtual reality” technology, are being developed and investigated. We are interested in not only related technological aspects, but also new “contents” which will be experienced by means of this new interface technology. The following research projects are included : (1) a space-sharing system realized by connecting high-definition virtual environments to a gigabit network, (2) multimodal interface technology such as a haptic interface device, and (3) mixed reality and wearable computers.	Prof. HIROSE, Michitaka (New students for academic year 2020 will not be accepted)
Fine Digital Engineering	Research into information systems in manufacturing fields is conducted in its two major domains. One is Digital Engineering Systems for strengthening product development performance. Innovative solution systems for design and manufacture are studied based on dedicated modeling technologies for three dimensional space and shapes. We concentrate on fundamental modeling theories and methods for discrete geometric modeling such as large scale dense meshes, 3D scanning, subdivision surfaces and volumes. Those models are also extended to other domains of computer graphics and digital human modeling. The other is research on integration and packaging of optical microsystems, which are key issues for realizing next generation information systems. In particular, we are studying room temperature bonding technique, optical surface mount technique, and wafer-level packaging for high-density and multifunctional optical devices. We are also working to develop new devices such as high-functional optical MEMS and high-sensitive optical microsensors using these techniques.	Prof. SUZUKI, Hiromasa
Networks and Mobile Systems	Our purpose is to identify opportunities and challenges for the Big Data / IoT (Internet of Things) / M2M (Machine-to-machine) driven Internet Economy posed by technical developments, and to address key technological questions for realizing "ICT as social infrastructure" and "ICT as experience". We conduct researches with emphasis both on designing network systems from application viewpoints and implementing "proof of concepts" prototypes. Our projects cover a large spectrum: - big data, IoT, and M2M - sensor networks - wireless communication systems - ubiquitous computing	Prof, MORIKAWA, Hiroyuki

Fields of study	Contents	Faculty
	- new generation network architecture. We also try to understand how trends in technological development give us new approaches for overcoming limits of the existing system architectures.	
Mathematical physics of emergent systems	The objective of our research is to elucidate the emergent behavior of complex systems in terms of mathematical physics, as well as considering real applications of the emergent systems. We are especially interested in “Jamology”, which is the interdisciplinary study of collective dynamics of self-driven particles, such as vehicles, and its jamming phenomena. The research subjects include reduction of traffic jam on highway, smooth evacuation of pedestrians, efficiency of social animals and their emergent behaviors, optimization of supply chain network. Some of the research topics are followings: 1) Prevention of traffic jam on highway by “jam-absorbing” driving 2) Theoretical study on road and airplane networks and their efficiency 3) Mathematical analysis on crowd behavior and its application to pedestrian flow in railway stations. 4) Collective behavior of ants and fishes, and their emergent properties 5) Efficiency of production network and supply chain management 6) Experimental study on granular flow	Prof. NISHINARI, Katsuhiro Assoc. Prof. YANAGISAWA, Daichi
Photon based Advanced Manufacturing Science	Research in our laboratory is conducted in its two major domains. One is a research on advanced micro/nano production technology, which can be applied to the next-generation ultra-precision manufacturing by focusing on photon energy. Especially we are developing photon based cutting-edge techniques for micro/nano manufacturing science, such as laser-assisted nano-in-process measurement, laser-assisted nano-processing and structuring, and a novel concept about a future micro production system, cell-in-micro-factory, with which we can product innovative micro/nano functional devices supporting our future life. The other is a research on developing theories for dynamical systems and methods of measurement in order to elucidate the underlying mechanisms of complex biological phenomena. We also apply the basic biological findings to a wide range of fields, including manufacturing workers' support, diagnosis, rehabilitation, and human interfaces.	Prof. Takahashi, Satoru Assoc. Prof. KOTANI, Kiyoshi
Information Somatics	Researches on “Information Somatics” is about supporting and augmenting innate functions of human such as sensory, motility, and intelligent processing. We investigate the mechanism of human body based on physical, physiological, and cognitive knowledge. Enhancing Human I/O We propound designing truly "Human-Computer Integrated" systems in a way that we control instruments and systems just like we control our own body. Augmented Human We enhance human ability by applying VR, AR, wearables, robot, and telexistence. Through this effort, we investigate a way to acquire new body schema. Sharing and Transferring subjective experience We aim to develop technologies that enrich our quality of life (QoL) as supplement by recording, reproducing, and transferring subjective experience.	Prof.INAMI,Masahiko Lecturer HIYAMA,Atsushi
Communication Science	Mathematical/Computational Exploration of Social Complex Systems: Language, Communication, and Financial Markets We explore the universal properties underlying large-scale social systems through mathematical models derived by computing with big data obtained from large-scale resources. Using these models, we explore new ways of engineering to aid human social activities. -Analysis of large-scale social systems by applying complex systems theory Common scaling properties are known to hold across various large-scale social systems. Using real, large-scale data, we study the nature of these properties from viewpoints such as complexity, degree of fluctuation and self-similarity, and construct a mathematical model that explains them.	Prof. TANAKA-ISHII, Kumiko

Fields of study	Contents	Faculty
	-Deep learning/machine learning methods for complex systems We discuss the potential and limitations of deep learning and other machine learning techniques with respect to the nature of complex systems, and we study directions for improvement. Moreover, we explore unsupervised and semi-supervised methods for state-of-the-art learning techniques. -Mathematical informatics across language, financial markets, and communication We explore common universal properties underlying language, finance, and communication, through computing with various kinds of large-scale data, and we apply our understanding of those properties to engineering across domains. For example, we study financial market analysis by using blogs and other information sources, and we simulate information spread on a large-scale communication network. Research Topics: (1) Mathematical informatics of social complex systems: language, communication and financial markets (2) Mathematical properties of symbolic systems such as long memory, complexity and self-similarity (3) Time series modeling using deep/machine learning (4) Universal properties across social complex systems.	
Networked biophotonics and microfluidics	Machines that think We ultimately aim at creating a machine that thinks by itself to discover something crazy with biology, physics and medicine outlooks. To this goal, we invent new physical tools to probe biological structures and realize ways of networking biological measurements using the world's best technologies. Our applications of interest span basic science and healthcare-industrial domains. Bridge biological measurement technologies With expertise in optics, microfluidics, electronics, material synthesis, genomics, and engineering, we develop integrative systems that network the biological measurements and interrogate complex life systems by exploiting the power of data science including machine learning. By transforming the engineering of quantitative biology, we are tackling fundamental and technological problems in biophysics, medicine and biology, and trying to explore the potential of such studies in healthcare. Develop bioimaging/sensing, micro/nanofluidics, and information technologies Toward the grand challenges mentioned above and independently, we actively work on development of novel optical imaging, functional micro/nanofluidics, and information techniques, and their integrated modalities. Along such scientific explorations, new technologies continually emerge and may spin out to create industrial activities with further excitement. I welcome applicants who are interested to study experimental optics, microfluidics, biophysics, information- and bio-technologies, and/or to create values by combining these disconnected technologies.	Assoc. Prof. OTA, Sadao
Biological Data Science	We are working to develop a bioinformatics method to analyze biomedical data and to understand disease and biological phenomenon centering on cancer. Our research includes following. 1. Epitranscriptome analysis Epitranscriptome is transcriptomics with biochemical modifications of RNA. We are developing method to detect RNA modification using next generation sequencer. (NGS) 2. Cancer genomics NGS is now used as clinical applications, in additions to a research use. We are working to develop a bioinformatics method to discover a new finding of cancer using Data Science technology that includes key driver mutation detections and multi-omics analysis of cancer 3. Bioinformatics data analysis using Data Science In order to find the biological knowledge from biological big data, it is necessary to aggregate data on a cloud and performs distributed processing. We are developing cloud based NGS analysis pipeline on the top of Hadoop / Spark, popular cloud computing framework, and conventional deep learning library.	Lecturer UEDA, Hiroki

Fields of study	Contents	Faculty
Biohybrid systems	The main research topic is the design and fabrication of bio-hybrid systems that combine bio functional materials with micro/nano devices. Since the size of the bio-molecular motors, such as kinesin-microtubule, is on the order of a few nanometers, they can work as a nano-sized bio functional elements in existing MEMS devices. Micro neural electrodes can be used as the neural interfaces between the living organs and artificial equipments. We are trying to build such hybrid systems through the micro/nano fabrication technologies. We welcome people from multidisciplinary backgrounds, including mechanics, informatics, biophysics, cell biology, material sciences.	Prof. TAKEUCHI, Shoji
Human Centered Urban Informatics	We work on the researches that lead human centered urban innovations smoothly by various spatial data and systems. Specifically, from mobile phone data, we are developing 1) reconstruction of moving objects such as people flow, 2) real-time monitoring of urban infrastructure such as roads and buildings and 3) open innovation regional management system cooperating with citizens.	Assoc. Prof. SEKIMOTO, Yoshihide
Supramolecular Materials Design	My group is interested in “applied” supramolecular chemistry. While previous work in the field of supramolecular chemistry centered mostly on fundamental research, current developments suggest such chemistry to be well poised to make significant contributions to various research fields. In particular, supramolecular sensors for biologically important species or pollutants are some of the most promising applications of molecular recognition materials. To be harnessed for rigorous analytical assignments, my research centers on molecular design and synthesis of materials as well as fabrication of devices. Chemical Sensors based on Organic Thin Film Transistors Functionalized with Molecular Recognition Materials : In the realm of electronics, organic thin-film transistors (OTFTs) are some of the most interesting devices owing to their flexibility, solution-processability and ultra-small thickness. Recently, interest in OTFTs and their advantages have extended beyond rollable information displays to sensor applications. OTFT-based physical sensors are being researched extensively, while chemical sensors are still in their early stages. In this regard, we are developing OTFT-based chemical sensors functionalized with supramolecular artificial receptors. High-throughput Analysis based on Supramolecular Sensor Arrays : A significant amount of attention is being devoted to the development of supramolecular sensor arrays, owing to their capability to recognize a number of analytes with high classification accuracy. With this in mind, we especially focus on simultaneous analysis of multi-analytes in biological fluids or environmental water. This can contribute to develop high-throughput analysis in the field of pharmacy, medicine and environment investigation.	Lecturer MINAMI, Tsuyoshi
Advanced Life Sciences		
Chemical Biotechnology	Research in our group is concerned with diverse aspects of the design and function of biopolymers on an atomic scale. The focus is on the molecular design, synthesis and physical properties of new, man-made biopolymers with various functions. Also included is the design of unprecedented organic chemical systems for recognizing and visualizing a single component or atom in biopolymers of interest. The lab employs a multidisciplinary approach involving organic synthesis, photophysical chemistry, state-of-the-art spectroscopy, and biological assays to address new approaches to the interface between synthetic chemistry and life science. (1) Chemistry creating nucleic acids Nucleic acid is a key molecule that controls vital functions. We create novel chemical reactions and functional biopolymers to specifically recognize the epigenetic modification of nucleic acids. We also pursue the highly functional photochemistry to visualize nucleic acid function in the cell.	Prof. OKAMOTO, Akimitsu Lecturer YAMAGUCHI, Satoshi
	(2) Chemistry building proteins Protein significantly changes its function by posttranslational modifications. We chemically synthesize proteins and peptides with a variety of posttranslational modifications. We also develop novel chemical reactions to specifically recognize/visualize posttranslational modifications. (3) Chemistry controlling cell function Cell functions may be controlled by sophisticated molecular design. We create the molecules expressing a function by an external stimulus after cell uptake and the molecules leading toward a specific cell function by wrapping the cells.	

Fields of study	Contents	Faculty
Chemical Biology and Biotechnology	We will aggressively incorporate chemical concepts and methods into biology. This multidisciplinary approach in fusion of chemistry and biology will generate unique and innovative research projects. The goal of our research is to uncover novel scientific notions and develop new biotechnology and drug leads. Our current research projects are (1) Reprogramming of the genetic code, (2) Novel drug seeds discovery using RaPID (Random non-standard Peptides Integrated Discover) system, (3) Generation of novel biological catalysts, (4) Drug discovery targeting to bacterial quorum sensing systems.	Prof. SUGA, Hiroaki
Metabolic Medicine	Metabolic syndrome is associated with obesity, hypertension, glucose intolerance, and insulin resistance, which frequently causes cardiovascular disease or stroke. In addition to DNA sequence of genome, an “epigenome” play important roles for cellular function and disease onset. The epigenome is acquired genetic information consisted of DNA methylation and histone post-translational modifications. The epigenome is cellular memory and is involved in gene expression, development, and environmental adaptation. Recent studies suggest that environmental cues determine abilities for fat accumulation and burning in adipocytes via epigenetic mechanisms. Our aim is to reveal cellular systems required for environmental adaptation in adipocytes. We utilize proteome, transcriptome, epigenome, and metabolome in adipocytes under environmental stresses and perform integrated analysis of multi-omics data. We will develop a new paradigm of lifestyle diseases based upon a concept of “Neo-nutritional Science”, which explain how nutritional environment is memorized as epigenome.	Prof. SAKAI, Juro Assoc. Prof. MATSUMURA, Yoshihiro
Genome Science	We are working to develop systems biology and medicine to understand biological systems by functional genomics approach. Novel technology and new types of algorithms are required for collecting, integrating and visualizing the enormous amount of data on gene expression, protein expression, and protein interactions arising in the wake of the Human Genome Project. Alliance with outside academics and industries will be crucial to the success of the new “systems biology”, i.e., understanding biological systems as more than the sum of their parts. 1. Systems biology of cancer: We have explored key molecules involved in carcinogenesis, through global analysis of gene expression, especially liver, lung and stomach cancer as major lethal cancers in Japan. 2. Technology development for genomic data acquisition: Novel analytical methods are being developed for gene copy number analysis and transcription factor binding. 3. Identification of novel biomarkers: Functional genomic approaches are applied to identify novel biomarkers for disease diagnostics and therapeutics. 4. Bioinformatics: The aim of this project is to reveal biological events in diseases with bioinformatics approach through integration of our proprietary gene expression data with public database of genome, transcriptome and ontogenic information. 5. Immunological networks: We are trying to decipher the complex interaction of the immune system with inflammatory disorders and develop new innovative tools to manipulate the immune system.	Prof. ABURATANI, Hiroyuki Project Assoc. Prof. TSUTSUMI, Shuichi Project Assoc. Prof. Yanai, Hideyuki Lecturer NAGAE, Genta
Bio Micromachine	Professor Ikuta is originally renowned for his pioneer work on Shape Memory Alloy (SMA) actuator and it's medical applications from the early 80's as the inventor of the world's first “Active Endoscope”. A lot of research on SMA micro actuators, including new control/sensing methods and micro fabrication of SMA thin film were done. He successfully developed the “Micro Stereo Lithography (IH process)” in 1992. This research is well recognized as a trigger work of three dimensional micro/nano fabrication. The resolution of micro/nano stereolithgraphy has already reached to 100 nm in 1999.	Lecturer IKEUCHI, Masashi
	He has been proposing the concept and investigating “Biochemical IC chips” (or “Chemical IC chip” in short) which is the micro chemical device including micro pump, reactor, detector and other micro components to construct overall micro chemical analysis and synthesis. This biochemical IC chips contribute the order-made medicine and wearable/ implantable device in near future. For these several years, he has been establishing new robotics and mechatronics field so called “Optical-driven nano robotics and machatronics” which can work in the liquid under micro scope to handle a cell and micro objects in micro biology. The concept of the optical driven nano mechatronics will contribute to both biomedicine and micro/nano fluidics.	

Fields of study	Contents	Faculty
	He is very active to develop unique types of medical robotics for minimally invasive surgery and non-invasive inspection ad well as above mentioned micro/nano machine for biomedicine. Recently he has been investigating “micro finger” for remote micro surgery in deep site, “safety active catheter” driven by hydro pressure and “Virtual Endoscope with force sensation “ so on..	
Synthetic Biology	By utilizing technology and methods from Genetics, Synthetic Biology, and Computational Biology, we aim to develop novel experiments and technologies to measure the dynamics of molecules, cells, and cellular development in order to unveil new biological phenomena. Our research projects include: (1) Development of new genome editing technologies (2) Development of technologies to trace cell lineages of cell development and cancer cell progression (3) High-throughput screening of protein interactions (4) Bioinformatics For details, please see http://yachie-lab.org	Assoc. Prof. YACHIE, Nozomu
Division of Integrative Nutriomics and Oncology	Cancer is one of the biggest issues of medicine and biology in the 21st century, and integration medicin, biology, engineering, and chemistry is essential for conquiring cancer. Recent years, it has become clear that the extreme microenvironment surrounding cancer cells (Tumor microenvironment) promotes cancer progression. Our laboratory aims to develop novel cancer treatments from the comprehensive Nutro-Omics approach by integration of multi-layer omics of cancer cell including genome, epigenome, transcriptome, proteome, metabolome in terms of tumor microenvironments. (1) Identification of novel cancer metabolites to promote cancer Cancer cells accumulate physiologically active cancer metabolites (known as oncotabolites) according to the extreme tumor microenvironments and contribute to aggressiveness of canccer such as cancer proliferation, invasion and metastasis. We aimed to identify unknown oncometabolites and examine their roles in cancer cells. (2) Understanding cancer metabolism in tumor microenvironments Cancer cells acquire malignancy in extreme tumor microenvironments such as hypoxia, nutrient deprivation and acidic pH. Our goal is to elucidate multi-layer cancer metabolic adaptations against carbohydrates, lipids and amino acids that have been studied by independent paradigms. (3) Development of cancer therapies through comprehensive “Nutriomics” approach Upon integration of genome, epigenome, transcriptome, proteome, and metabolome data through the comprehensive “nutria-omics” approach, we try to clarify the transcriptional-metabolic system in cancer cells accompanying tumor microenvironment, leading to the development of novel anti-cancer treatments.	Assoc. Prof. OSAWA, Tsuyoshi
	The Laboratory for Systems Biology and Medicine (LSBM) consists of four divisions, which are focusing on research in the area of cancer, metabolic syndrome (obesity and type 2 diabetes) and vascular disease (arteriosclerosis, pathological angiogenesis and clots). Combining advanced techniques in cellular and molecular biology with the power of bioinformatics, we aim to dissect the physiological and pathological ‘live system’ in human. Field of Study: Signal transduction mechanism of cell Contents:The focus of our research is to understand the molecular mechanism and physiology of G protein-mediated signaling transduction which is the most widely used signaling mechanism in our body. In addition, GPCRs (G protein coupled receptors) are the most important targets for drug development. Our pproaches include protein biochemistry with purified components, X-ray crystallography, proteomics, and dynamical analysis of cell signaling using various biophysical methods such as SPR or FRET. The current specific focus is on the regulation of GPCR-mediated activation of Rho family GTPases which are involved in a variety of cellular functions and cancer status by controlling the organization of actin cytoskeleton or gene expression. We are also collaborating the group of computer simulation to develop novel drugs for GPCR signaling [Vascular Nucleome] WADA, Youichiro	Prof. WADA, Youichiro Assoc. Prof. KAWAMURA, Takeshi Project Prof. TANAKA, Toshiya Project Assoc. Prof. YAMASHITA, Takefumi

Fields of study	Contents	Faculty
	aTo understand pathogenesis and achieve development of new therapy for cardiovascular diseases, including myocardial infarction and angina pectoris. Especially, we focus on the significance of chromatin dynamics in gene regulation, and are performing genome-epigenome experiments with high time-resolution by humanoid robotics. In collaboration with mathematician, we construct mathematical model using big data and elucidate the hypothesis named transcription factory.	
Intellectual Property Law	Intellectual property law deals with various issues to be discussed when economically valuable information is legally treated as “property”. Originally belonging to the field of law, Intellectual property law is quite interdisciplinary, often requiring technological knowledge. Our goal is to promote collaborative research among researchers with various backgrounds from law and engineering to economics and policy studies, etc. Also, we would like to expand our research area to new fields such as brand management and content production.	Prof. TAMAI, Katsuya Assoc. Prof. MASUDA, Sachiko

5. Getting to Dept. of Advanced Interdisciplinary Studies at Komaba Research Campus

- 7-minute walk from Higashi-Kitazawa Station, Odakyu Line/Subway Chiyoda Line
- 10-minute walk from Komaba-Todaimae Station, Keio Inokashira Line
- 10-minute walk from Ikenoue Station, Keio Inokashira Line
- 12-minute walk from Yoyogi-Uehara Station, Odakyu Line/Subway Chiyoda Line
- 15-minute bus ride from Shibuya Station to “Komaba Research Campus” bus stop (catch Tokyu Bus no. 55 at stop 18 of bus terminal at West exit of Shibuya Station)