2022 Engineering Science 21st Century Master's and Doctoral Course Program for Foreign Students with a MEXT Scholarship

"Special Training Program for Robotics Engineers for the Post-Corona Society"

Graduate School of Engineering Science, Osaka University

1-3, Machikaneyama, Toyonaka, Osaka 560-8531 JAPAN
Email address: ki-daigakuin@office.osaka-u.ac.jp
Website URL: http://osku.jp/r0592

August 2021

2022 Engineering Science 21st Century Master's and Doctoral Course Program for Foreign Students with a MEXT Scholarship

Graduate School of Engineering Science, OSAKA UNIVERSITY

The Graduate School of Engineering Science at Osaka University features one of our MEXT-granted programs: "Special Training Program for Robotics Engineers for the Post-Corona Society" in English, which starts in October 2022.

The Graduate School of Engineering Science is one of the world-leading schools in the field of Robotics Engineering. Under this program featuring Robotics Engineering as well as other related areas, we would like to welcome top-notch foreign students from all over the world.

Based on our educational philosophy: "Fundamentally developing scientific technology by integrating science and technology will create a true culture of humanity," we will nurture human resources who possess a broad spectrum of multidisciplinary expertise, rich comprehensive understanding, synthetic imagination, and transcultural communicability, associated with Robotics-Engineering-related professional capability and skills, who can also contribute to establishing future Robotics industries in their home countries as well as promoting close cooperation with the Japanese industry, academia, and government internationally.

The detailed application guide is as follows.

Note: MEXT stands for the Ministry of Education, Culture, Sports, Science and Technology of the Japanese Government.

1. Admission Capacity

Master's Course

Four (4) students in total for the three departments below

Doctoral Course

Four (4) students* in total for the three departments below

*Students currently enrolled in the master's course for this program who apply for the doctoral course will be given priority, but this does not mean that other applicants are not competitive candidates as well, so long as space allows.

Department of Materials Engineering Science
Department of Mechanical Science and Bioengineering
Department of Systems Innovation

Research areas and topics can be found at the website: osku.jp/n0961
With respect to advancing to the Doctoral Course, you will need to refer to Section 10. Note (4) below.

2. Application Requirements

(1) Nationality: The applicant's nationality must be of a country that has diplomatic relations with the Japanese government.
(2) Visa requirement: Non-Japanese nationals who are expected to obtain a resident visa (Student Visa) upon enrollment in the Graduate School, under the Immigration-Control and Refugee-Recognition Act.
(3) Age: Applicants generally are required to have been born on or after April 2, 1987.
(4) Applicants are required to have fulfilled at least one of the following items:

A Master's Course applicant

(a) has received a Bachelor's degree from a Japanese university/college or is expected to graduate prior to the date of enrollment to the course;
(b) has completed 16 years of formal school education curriculum in countries other than Japan and either has received a Bachelor's degree, or is expected to graduate from a university/college prior to

the date of enrollment to the course;

(c) has received the equivalent of a Bachelor's degree through the completion of coursework which requires 3 or more years of study at an overseas university/college; or

(d) is approved of being equivalent academically to a university graduate by the Graduate School of Engineering Science, Osaka University and is at least 22 years of age prior to the date of enrollment to the course.

A Doctoral Course applicant

(a) has received a Master's degree from a university or is expected to complete a Master's course curriculum prior to the date of enrollment to our Doctoral Course;

(b) has either received a Bachelor's degree from a Japanese university, or completed 16 years of formal school education curriculum in countries other than Japan followed by at least 2 years of research experience at universities/research institutes, and is approved of having research ability by referring their research achievement as being equivalent to Master's degree level by the Graduate School of Engineering Science, Osaka University; or

(c) is approved of being academically equivalent to a Master's Course graduate by the Graduate School of Engineering Science, Osaka University and is at least 24 years of age prior to the date of enrollment to our Doctoral Course.

(5) Language ability: Required English proficiency above 79 for TOEFL-iBT, 213 for TOEFL-CBT, 550 for TOEFL-PBT, 6.0 for IELTS or equivalent.

(6) Attendance availability: Applicants should arrive in Japan immediately prior to the date of enrollment and start the course on the date of enrollment.

(7) While the applicant is studying in Japan, he/she shall contribute to mutual understanding between Japan and the home country by participating in activities at schools and communities with the aim of contributing to the internationalization of Japan. The applicant shall make efforts to promote relations between the home country and Japan by maintaining close relations with the university attended after graduation, cooperating with the conducting of surveys and questionnaires after returning home, and cooperating with all relevant projects and events conducted by Japanese diplomatic missions in the applicant's home country.

(8) Notes on ineligible applicants:

(a) Members of the armed forces

(b) The applicant who is a previous recipient of a Japanese government (MEXT) scholarship; provided, those that have educational research experience of three years or more from the first day of the month following the final payment of the previous scholarship to the beginning of the payment of this scholarship are excluded. In addition, this does not apply to the past recipients of Japanese studies scholarships or Japan-Korea Joint Government Scholarship Program for the Students in Science and Engineering Departments or Young Leaders Program who are eligible to apply as long as they enter the universities as research students;

(c) Those who are currently applying for other programs by a Japanese government (MEXT).

(d) Those who are currently enrolled at a Japanese university with a Student Visa; those enrolled, or scheduled to be enrolled, at a Japanese university as a privately financed international student during the period when the scholarship application was filed until prior to the start of the provision of the scholarship. This does not apply to current self-financed international students at Japanese universities who will complete their courses of study and return to their countries once before the end of the current fiscal year.

(e) Recipients of scholarships from institutions (including government institutions in their home countries) other than Japanese government (MEXT) and Japan Student Services Organization (JASSO) (including the prospective beneficiaries). Those who have been selected by support programs for international students that are organized by Japanese government (MEXT) or Japan Student Services Organization (JASSO) and continue to be at the university on or after October 2022 are included.

(f) Applicants who are expected to graduate at the time of application and cannot satisfy the qualifications and the conditions related to academic background by the deadline given.

(g) Holders of dual nationality at the time of application who cannot verify that they will give up Japanese nationality by the time of his or her arrival in Japan.

(h) Applicants who wish, from the time of application, to conduct fieldwork or participate in an internship outside of Japan.

3. Pre-application Screening

Among the Application Requirements mentioned above, those who intend to apply for the Course under (4)-(d) are required to undergo a pre-application screening before application. Please contact the Graduate Students Section in advance before the application deadline by email (ki-daigakuin@office.osaka-u.ac.jp) to inquire about the necessary procedures.

4. Application Procedure

(1) Application Period:

Monday, November 15, 2021, to Monday, November 29, 2021

Note: To the extent possible, every applicant is asked to find a supervisor suitable for the research field in which the applicant is interested by contacting him/her by email to confirm whether the field will be appropriate for his/her laboratory. The research topics of faculty members of the Graduate School of Engineering Science can be found in the attached list and can also be found at the following website: osku.jp/n0961

(2) Application Procedure:

All the application documents (a)-(h) (see below) should be scanned into PDF format(s), and the PDF document(s) are to be submitted to the Graduate Students Section via e-mail within the application period (Japan Standard Time/JST).

Graduate Students Section, Graduate School of Engineering Science, Osaka University
1-3 Machikaneyama, Toyonaka, Osaka 560-8531 JAPAN
Email: ki-daigakuin@office.osaka-u.ac.jp
Phone: +81-6-6850-6146

No application will be accepted if the documents are incomplete. Once the application procedure is completed, the submitted contents cannot be altered. If any of the application documents are falsified, admission will be cancelled even after he/she has enrolled.

Note: After document screening, successful applicants are required to submit all the original application documents (a)-(i) (NOT SCANNED) by registered *postal* mail such as Express Mail Service (EMS) by the designated date to the above address.

(3) Application documents:

It is essential that all the application documents (a)-(h) should be carefully completed in English, typed/printed or written in block letters (i.e. they must be written legibly in printed letters, sans-serif fonts, and not in cursive, so that it can be read easily.) on A4- or US letter-sized white paper. Official English translation is required for every formal document given in other languages. Application documents are non-returnable.

(a) Form "Application for Admission for 2022 Engineering Science 21st Century Master's and Doctoral Course Program for Foreign Students with a MEXT Scholarship" completed and signed.
(b) "Details of proposed study" completed in about 2,000 words on the prescribed form.
(c) Abstract of applicant's Bachelor thesis for Master's Course application or that of Master's thesis for Doctoral Course application, written in English within 2,000 words on the prescribed form.
(d) Official document certifying the date or expected date of applicant's graduation issued and signed by the officials of the most recent university or graduate school.
(e) Academic records, which also indicate the GPA or its equivalent and its full score, issued and signed by officials of the most recent university or graduate school.
(f) A copy of certificate of citizenship or a copy of the applicant's passport on an A4- or US letter-sized paper.
(g) Score report (original document) of the TOEFL test or equivalent as a certificate of English proficiency except for the cases below. Your TOEFL score may be sent to us directly from ETS. Our ETS institution code is 5413.
  - Applicants whose first language is English.
  - Applicants who have graduated from a university located in an English speaking country.
  - Applicants who have completed an undergraduate degree program where the language of instruction and examination was English. In this case, an official statement from the academic institution will be required, confirming the use of English as the language of instructions and examinations.
(h) Recommendation letter from the Dean of the faculty or school from which the applicant has graduated to the president of Osaka University. When the applicant is an employee, a recommendation letter from the employer/executives will also be accepted.

(i) One (1) photo 3.2 by 2.6 cm in size.
- Color
- Printed on photo quality paper.
- Taken within the last 6 months prior to the application date to reflect the current appearance.
- Taken clearly in front of a plain background.
- Taken in full-face view directly facing the camera including upper body.
- With a neutral facial expression and both eyes open. Do not wear a hat or head covering.
- Write your name and nationality in block letters on the back of the photo.

5. Screening

(1) **First screening:** Screening of applicants will be held on the basis of the application documents by the Graduate School of Engineering Science, Osaka University within the month of December 2021.
An interview and academic examination will be conducted for those who have passed the initial application document screening within the month of January 2022.

(2) **Second screening:** MEXT will decide the recipients of the MEXT Scholarship among the recommended preliminary candidates selected by the Graduate School of Engineering Science, Osaka University.

6. Notification of Results

The result of the first screening will be mailed to the applicants by the middle of February 2022.
The result of the second screening will be mailed to the applicants at the beginning of July 2022.
Inquiry about the results by telephone etc. is strictly prohibited.

7. Date of Enrollment to the Course

October 1st, 2022

8. Policy on Handling Personal Information

(1) Names, addresses, and other personal information will be used in the entrance examination process, in the publication of the list of successful applicants, and in the admission procedures. For those admitted to Osaka University, personal information will also be used for academic-related matters (keeping academic and registration records), for student support matters (health care management, school fee exemptions and applications for scholarships, career support, etc.), and for school fee management.

(2) The information obtained from the entrance examination such as grade statistics and analysis will be used for research on admission methods.

9. Security Export Control

At Osaka University, Security Export Control is conducted in accordance with the "Foreign Exchange and Foreign Trade Act" for the purpose of maintaining the peace and security of Japan and the international community. Applicants who fall under the conditions set out in said regulations may not be able to enroll in their desired course or program or carry out research activities.

10. Note

(1) Applicants are recommended to become well acquainted with the Japanese language, culture, customs, among others. Knowledge of Japanese is useful for daily life.

(2) Preliminary candidates for the MEXT Scholarship will be requested to additionally submit the "Application Documents for MEXT Scholarship" after the initial screening of application documents as well as interview/examination conducted by Osaka University. Prescribed application forms will be sent to the preliminary candidates by e-mail by the end of February 2022.

(3) The MEXT Scholarship shall be provided in accordance with the rules set forth by the Japanese Government.

(4) If a grantee desires to advance to a Doctoral course from a Master's course, he/she may have the term of his/her scholarship extended upon a successful examination by MEXT and Osaka University, provided that he/she has made outstanding academic achievement that meets certain criteria. Refer to Appendix for Admission 2022,

4. EXTENSION OF PERIOD OF SCHOLARSHIP.

11. Requests for Application Forms

Application forms are to be downloaded from the website: http://osku.jp/r0592

For any matters concerning admission, please contact the Graduate Students Section via email:

Graduate Students Section
Graduate School of Engineering Science, Osaka University
1-3, Machikaneyama, Toyonaka, Osaka 560-8531 JAPAN
Email: ki-daigakuin@office.osaka-u.ac.jp

Appendix for Admission 2022

1. PERIOD OF SCHOLARSHIP

Regardless of the date of arrival, the scholarship period shall be the necessary period for the completion of the regular program of the respective courses. Students repeating a year will not be granted.

2. SCHOLARSHIP BENEFITS

(1) Allowance: The amount listed below shall be paid depending on the course enrolled in. Due to the situation of the Japanese Government's budget, the amount of payment may be subject to change each fiscal year. The scholarship shall be cancelled if a grantee is absent from the university for an extended period.

a) Regular students enrolled in master's courses: 147,000 yen per month.

b) Regular students enrolled in doctoral courses: 148,000 yen per month.

(2) Education fees: Fees for the application, entrance and tuition at Osaka University will be exempted. The application fee will not be exempted if the grantees cannot proceed to the master's or doctoral course or cannot be admitted by the university.

(3) Transportation Expenses

a) Transportation to Japan: MEXT provides an economy-class airline ticket for the flight from the international airport closest to the grantee's residence (in principle, the country of nationality) to the first international airport that the grantee flies into when he/she arrives in Japan.

b) Transportation from Japan: MEXT, in principle, shall provide an economy-class airline ticket from Kansai International Airport to the international airport (in principle, in the country of nationality) nearest to the returning grantee's residence to grantees graduating Osaka University and returning to the home country by the end of the final month of the period of scholarship designated by MEXT.

Note 1: The grantee shall bear at his/her own expense all costs related to domestic travel from the grantee's residence to the nearest international airport, airport taxes, airport usage fees, special taxes necessary for travel, travel expenses within Japan (including airline transit costs), travel insurance expenses, carry-on luggage or unaccompanied baggage expenses, etc. This is the same for when the grantee returns to his/her home country.

Note 2: If a grantee returns to the home country before the end of period of scholarship due to personal circumstances, or reasons stated in "3. SUSPENSION OF PAYMENT OF SCHOLARSHIP", MEXT will not pay for the returning travel expenses.

Note 3: If a grantee continues to stay in Japan after the scholarship period has ended in cases such as being employed in Japan, he/she will not be paid travel expenses for a temporary return.

3. SUSPENSION OF PAYMENT OF SCHOLARSHIP

Payment of the scholarship will be stopped for the reasons given below. Should any of the following reasons apply, the grantee may be ordered to return a part of, or all of, the scholarship paid up to that time. Payment of the scholarship may also be stopped during the period up to the decision on the disposition of the matter.

(1) A grantee is determined to have made a false statement on his/her application.

(2) A grantee violates any article of his/her pledge to the Minister of Education, Culture, Sports, Science and Technology.

(3) A grantee violates any Japanese laws and is sentenced and imprisoned for an indefinite period or for a period exceeding 1 year.

(4) A grantee is suspended from his/her university or preparatory educational institution or receives other punishment, or is removed from enrollment; in accordance with school regulations of the accepting institution.

(5) It has been determined that it will be impossible for a grantee to complete the course within the standard time period because of poor academic grades or suspension or absence from the university.

(6) A grantee came to Japan without newly acquiring the "Student" residence status, or changed his/her residence status to one other than "Student".

(7) A grantee has received another scholarship (excluding those specified for research expenditures) .
(8) A grantee proceeds to a more advanced level of education without receiving approval for an extension of the period of the scholarship.
(9) A grantee has quit Osaka University or has transferred to another graduate school.
(10) A grantee's yearly academic coefficient at each point in time is less than 2.30.

4. EXTENSION OF PERIOD OF SCHOLARSHIP

If a grantee desires to proceed to a doctoral course from a master's course, he/she may have the term of his/her scholarship extended upon a successful examination by MEXT and Osaka University and provided that he/she has made outstanding academic achievement that meets certain criteria. This will be implemented according to the proceeding of the program, provided that there are cases where the scholarship extension may be applied for the 2022 master's course students who subsequently wish to continue studying in the doctoral course.

5. NATIONALITY

Applicants must have the nationality of a country that has diplomatic relations with Japan. An applicant who has Japanese nationality at the time of application is not eligible. However, persons with dual nationality who hold Japanese nationality and whose place of residence at the time of application is outside of Japan are eligible to apply as long as they choose the nationality of the other country and renounce their Japanese nationality by the date of their arrival in Japan.

As of April 2021, Graduate School of Engineering Science, Osaka University

Department of Materials Engineering Science

Division	Area	Research Group	Keywords	Professor
Materials Physics	Electron Correlation Physics	Theoretical Research Group of Strongly Correlated Systems	Topological insulators and superconductors, Exotic superconductors, Strongly correlated electron systems, Quantum magnetism, Quantum criticality, Mathematical physics	Prof. FUJIMOTO Satoshi
		Experimental Research Group for Spectroscopy of Correlated Materials	Polarization-dependent bulk-sensitive photoelectron spectroscopy (hard X-ray and extremely low-energy excitation), Bulk-sensitive soft x-ray angle-resolved photoemission and their dichroism	Prof. SEKIYAMA Akira
		Experimental Research Group for Electron-correlated Matter Science	Exotic superconductors, Topological superconductors, Quantum critical systems, Multipolar systems, Strongly correlated electron systems, Angle-resolved thermal-transport/thermodynamic measurements under extreme conditions	Prof. IZAWA Koichi
	Quantum Physics of Nanoscale Materials	Quantum Information and Quantum Optics Group	Quantum information proccessing, Entanglement manipulation, Quantum optics, Atom Optics, Optomechanics	Prof.Takashi Yamamoto
		Group for Exploration of Functional Materials	Magnetism, Ferroelectricity, Correlated electron systems, Oxides, Crystal growth	Prof. Shintaro Ishiwata
		Experimental Research Group for Nanoscience	Nanostructures, Spintronics	Prof. SUZUKI Yoshishige
	Quantum Materials Physics	Interface Quantum Science	Spintronics, Flexible Spintronics, Advanced magnetic engineering, Control of magnetism, Functional quantum interface	Prof.Daichi Chiba
Chemistry	Synthetic Chemistry	Synthetic Organic Chemistry Group	Environmentally benign process for molecular transformations, Simulation of enzymatic functions with metallo- and organocatalysts, Creation of functional orgaometallics	Prof. NAOTA Takeshi
		Physical Organic Chemistry Group	Reaction Development, Mechanistic Analysis, Functional Molecule Synthesis, Structure-Property Evaluation, Catalytic Reaction, Asymmetric Catalysis	Prof. SHINTANI Ryo
		Molecular Assembly Chemistry Group	Supramolecular chemistry, Crystal engineering, Functional crystalline material, Porous organic framework, Carbon dioxide absorbent, Hydrogen bond	Prof. HISAKI Ichiro
	Molecular Organization Chemistry	Surface Chemistry Group	Energy Conversion, Electrode Interfaces, Ionic Liquid Interfacial Chemistry, Catalytic Reaction Mechanism, Chemical Sensor, Interfaces of Electrochemical Devices	Prof. FUKUI Ken-ichi
		Biological Chemistry Group	Nucleic acids chemistry, Chemical synthesis of oligonucleotides, DNA damage, DNA repair, Biomolecular recognition, Protein–nucleic acid interactions	Prof. IWAI Shigenori
	Solar Energy Chemistry	Solar Energy Conversion	Artificial Photosynthesis; Natural Photosynthesis; Light-to-chemical energy conversion; Photofunctional materials; Electrocatalytic reactions; Next-generation secondary batteries	Prof. NAKANISHI Shuji
Chemical Engineering	Chemical Reaction Engineering	Nanoreaction Engineering Group	Chemical reaction engineering, porous materials, inorganic membranes, liquid crystals	Prof. NISHIYAMA Norikazu
		Quantum Chemical Engineering group	Quantum nonlinear optics, Materials-oriented quantum chemistry, Open-shell molecular systems, Quantum dynamics	Prof. NAKANO Masayoshi
		Design of High-Performance Catalyst Group	Catalytic chemistry, Catalyst design, Green chemistry, Environmentally-benign catalytic process, Green organic synthesis, Inorganic crystallites, Nanocluster, Highly ordered multicomponent catalyst	Prof. MIZUGAKI Tomoo
	Environment and Energy System	Transport Phenomena Control Group	Control of Heat and Mass Trasnfer, Liquid-Liquid Interface, Phase Change, Computational Fluid Dynamics	Prof. OKANO Yasunori
		Molecular-Aggregate Chemical Engineering Group	Soft Self-Organizing System, Distribution of Molecule at Mesoscale, Amphiphilic Molecule, Ionic Liquid, Molecular Simulation, Solution Theory	Prof. MATUBAYASI Nobuyuki
	Bioprocess Engineering	Bio-Inspired Chemical Engineering Group	Bio-Inspired Chemical Engineering, Self-Assemblies, Engineering Science of Liposome, Molecular Recognition, Artificial Enzyme, Bioseparation	Prof. UMAKOSHI Hiroshi
		Biochemical Materials Engineering Group	Biomedical, Biomaterial, Tissue fabrication, Hydrogel, Soft matter, Biochemical engineering	Prof. SAKAI Shinji
	Solar Energy Chemistry	Energy and Photochemical Engineering Group	Photocatalysts, Artificial Photosynthesis, Photoluminescent Molecular Devices and Sensors	Prof. HIRAI Takayuki
Frontier Materials Science	Frontier Materials	Molecular Architectonics Research Group	Experimental and Theoretical Studies on Molecular-based and Molecular-scale Electronics, Spintronics and Thermoelectronics, and on Novel Molecular Architectures utilizing Fluctuations towards Brain-like Devices	Prof. TADA Hirokazu
		Organometallic Chemistry Group	Design and Synthesis of Homogeneous Molecular Catalysts, Organometallic Complexes, Metal Nanoclusters, Chiral Complexes, and Molecular Devices	Prof. MASHIMA Kazushi
		Theoretical Group for Photophysics in Nanomaterials	Microscopic theory of light-matter interaction, Photo-functional design with nano-materials, Optical manipulation of nanostructures, Theory of nonlinear optical response of solids	Prof. ISHIHARA Hajime
	Dynamics of Nanoscale Materials	Experimental Research Group for Coherence of Nanoscale Materials	Optical properties of semiconductor ultrathin films and nanoparticles, and strongly-correlated electron systems, Nonlinear laser spectroscopy, Ultrafast time-resolved spectroscopy, THz spectroscopy, SEM-cathodoluminescence, Optical fabrication and manipulation of nanoparticles	Prof. ASHIDA Masaaki
		Experimental Research Group for Fluctuation Dynamics in Condensed Phase	photochemistry, photofunctional molecule, three-dimensional three-pulse photon echo, ultrafast detection of photochemical reactions, laser-control of chemical reactions, time-resolved microscopy, single-molecule measurement, biomolecular fluctuation	Prof. MIYASAKA Hiroshi
	Quantum Science in Extreme Conditions	Experimental Research Group for Materials Science in Extreme Conditions	Material science at extreme conditions; Superconductivity, magnetism, structural phase transitions, new material and new function	Prof. SHIMIZU Katsuya
		Experimental Research Group for Materials Engineering Science in Nano-structure	Nano-fabrication of solids and semiconductors, Hetero-structure of oxides, Nano-materials device, Electronics of functional oxides	Prof. TANAKA Hidekazu

As of April 2021, Graduate School of Engineering Science, Osaka University

Department of Mechanical Science and Bioengineering

Division	Area	Research Group	Keywords	Professor
Nonlinear Mechanics	Mechanics of Fluids and Thermo-fluids	Thermal Engineering and Science Group	Subcritical transition to turbulence, Fully developed turbulence, Flow control, Heat transfer enhancement, Drag reduction	Prof. KAWAHARA Genta
		Fluid Mechanics Group	Science and technology of nonlinear phenomena in fluid mechanics, Transport and mixing, Turbulent flows, Granular flows, Flows of complex fluids, Interfacial flows	Prof. GOTO Susumu
	Mechanics of Solid Materials	Structure and strength of materials group	Nanomechanics and physics, Plasticity, Ceramics, Semiconductor, Ferroelectrics, Theory of dislocations, Transmission Electron Microscopy, Scanning Probe Microscopy, Nanoindentation, Photoplastic effect, Multiphysics, Quantitative evaluation of hydrogen embrittlement of metals, Material properties of hydrogen energy materials	Prof. NAKAMURA Atsutomo
		Solid Mechanics Group	Theory of elasticity, Isogeometric analysis, Multiscale analysis, Mechanics of defects in solid, Large scale computation, Structure optimization, Resonant ultrasound spectroscopy, Gas sensor, Dynamics of colloidal materials	Prof. TARUMI Ryuichi
Mechanical Engineering	Propulsion Engineering	Molecular Fluid Dynamics Group	Control and analysis of nanoparticle flow dynamics by optical pressure and optical vortex, Development of micro-machined artificial auditory sensory epithelium using AI, Molecular fluid sciences of single-molecule measurement technology, Integration of Deep Learning to intelligent flow measurement and simulation	Prof. KAWANO Satoyuki
		Fluids Engineering Group	Multiphase Flows, Cavitating Flows, Flow Control, Numerical Scheme and Algorithm, High Performance Computing, Optical Measurements	Prof. SUGIYAMA Kazuyasu
	Mechano-informatics	Human Motor Control and Human Enhancement Group	Computer assisted surgery, Medical robotics, Endoscopic surgery assistance, Skilled and coordinated movements, Functional electrical stimulation, Neurorehabilitation, Sports science, Human enhancement technology	Prof. NISHIKAWA Atsushi
		Theoretical Solid Mechanics Group	Multiscale-multiphysics modeling for the deformation, fracture, corrosion, and friction behaviors of materials, Prediction and design of the mechanical properties of materials, Electronic and atomistic simulation, Micro-Meso-Macro-mechanics, Machine learning, Structural materials with high strength and ductility,High-entropy alloys, Materials with mille-feuille structures, Nanostructured materials, Amorphous materials, Nano-materials	Prof.OGATA Shigenobu
Bioengineering	Biomechanical Science	Biomechanics Group	Biomechanics of cells, tissues, and organs, Functional adaptation and remodeling, Computational biomechanics, Biofluid dynamics, Biomechanical Imaging, Biomolecular dynamics	Prof. WADA Shigeo
		Mechanical and Bioengineering Systems Group	Biomechanical System Modeling, Biomechanical Simulation, Orthopaedic/Dental Biomechanics, Musculo-Skeletal Dynamics, Rehabilitation Engineering, Welfare Engineering, Assistive Technology, Adaptive Structures and Systems, Optimum/Adaptive Structural Design, Smart System Design	To be decided
		BioMedical Engineering	Medical Device, Artificial Organs, Biosensing, Bioinformation Monitoring, Biomaterials, Medical Imaging	Guest Prof. TSUKIYA Tomonori
	Biophysical Engineering	Bio-Dynamics Group	Human motor control, Posture and Gait, Neuro-mechanics, Neuro-rehabilitation, Neuro-engineering, Biomedical Engineering, Computational Neuroscience, Systems Physiology, Biosignal processing, Nonlinear dynamical system theory and its application to physiology and medicine	Prof. NOMURA Taishin
		Biological Physics and Data Science Group	Biological statistical physics, Nonlinear time series analysis and its application to biosignals, Biomedical big-data analysis, Healthcare cyber-physical system.	Prof. KIYONO Ken
	Biomedical and Biophysical Measurements	Molecular BioMeasurement Group	Cellular adaptation to mechanical engineronment, Physical/biochemical properties of cells and subcellular components, Bioengineering-based drug repositioning, Cell biomechanics/biophysics and mechanobiology, Soft matter physics, Microfluidics	Prof. DEGUCHI Shinji
		Bioimaging Group	Smart Sensing, Presentation, Multipurpose Display, VR/AR, Computer Vision, SLAM, Image Measurement, Sensory Information Processing, Mechatronics, Functional Material, Digital Fabrication, Soft Robotics, Food Design	Prof. OSHIRO Osamu

As of April 2021, Graduate School of Engineering Science, Osaka University

Department of Systems Innovation

Division	Area	Research Group	Keywords	Professor
Advanced Electronics and Optical Science	Solid State Electronics	Nanoelectronics Group	Nitride semiconductor materials, Memristor, Group-IV semiconductor materials, AI electronics, Syncrotron radiation nanobeam X-ray diffraction, Scanning probe microscopy, Transmission electron microscopy, Quantum beam nanofabrication, First principles calculation	Prof. SAKAI Akira
		Nanostructure Physics Group	Nanostructure physics, Low-dimensional structures / Superlattices, Thermoelectric conversion, Phonon engineering, Group-IV semiconductor materials, Transparent oxide materials, Molecular beam epitaxy	Prof. NAKAMURA Yoshiaki
		Nano-scale Physics & Device Group	Semiconductor spintronics, Low-temperature MBE, Metal/Semiconductor interface, Semiconductor/Oxide interface, Interfacial multiferroics	Prof. HAMAYA Kohei
	Advanced Quantum Devices and Electronics	Quantum Computing Group	Quantum computer, Quantum algorithm, Quantum complexity theory, Quantum error correction, Fault-tolerant quantum computing, Quantum machine learning, Quantum information theory, Quantum dynamics	Prof. FUJII Keisuke
		Advanced Quantum Information Device Group	Quantum measurement and sensing, Ultra high-sensitivity MRI/NMR, Room temperature hyper polarization, Quantum sensitive coding, Quantum information experiment	Prof. KITAGAWA Masahiro
	Optical Electronics	Microwave Photonics Group	Artificial metamaterials,Transformation optics, Invisibility cloaks, Left-handed materials, Photonics crystals, Plasmonic devices, Microwaves, Wireless communications	Prof. SANADA Atsushi
		Information Photonics Group	Millimeter- and terahertz-wave photonics, Nano-structure photonics, Metamaterials, Ultrafast electronics, Photonic signal processing and measurement, Communication systems	Prof. NAGATSUMA Tadao
		Quantum Electronics Group	Quantum sensing, Quantum information, Quantum optics, Ion trap, Laser cooling, quantum gases, superfluidity, ultracold chemistry	Prof. MUKAIYAMA Takashi
	Advanced Electronics Under Extreme Conditions	Advanced Electronics Group	Atom technology, Nanobiology, Nanoelectronics, Scanning Probe Microscopy, Medical Enginnering, Nanometer analysis and characterization	Prof. ABE Masayuki
Systems Science and Applied Informatics	System Theory	Adaptive Robotics Group	Soft Robotics, Embodied Artificial Intelligence, Bio-mimetic Robotics, Bio-Robotics, Muscular-skeletal Robots, Humanoid Robots	Prof. HOSODA Koh
		Systems Analysis Group	Signals and Systems Analysis, Adaptive System, Speech Intelligibility, Active Noise Cancellation, Image Understanding and Restoration, Feature Extraction and Classification	Prof. IIGUNI Youji
	Intelligent Systems	Robot Learning Group	AIxRobotics, Machine Learning, Symbol Emergence in Robotics, Developmental Cognitive Robotics, Domestic Service Robots, Emotional Intelligence, Haptic Intelligence, Child-Robot Interaction	Prof. NAGAI Takayuki
		Intelligent Robotics Group	Human-Robot Interaction, Android Science, Communication robots, Learning and cognitive developmental Robot, Bio-mimetic system, Intelligent sensor network, Pattern recognition, Brain-Machine Interface	Prof. ISHIGURO Hiroshi
		Pattern Measurement Group	Computer Vision, Visual Media, Olfactory Media, Virtual Reality, Augmented/Mixed Reality, Intelligent Sensing, Human Activity Sensing, Sensor Fusion, Digital Archive, Human Interface, Human Augmentation	Prof. SATO Kosuke
		Robotic Manipulation Research Group	Robot Manipulator, Robotic Hand, Motion Planning, Motion Analysis, Assembly, Machine Learning, Industrial Robot, Humanoid Robot	Prof. HARADA Kensuke
Mathematical Science	Mathematical Modelling	Differential Equation Group	Nonlinear partial differential equations, Variational methods, Singularity formation, Mathematical fluid dynamics, Mathematical sciences	Prof.KOBAYASHI Takayuki
		Applied Analysis Group	Mathematical models of phenomena, Nonlinear analysis, Nonliear differential equations, Variational methods, Dynamical systems, Blow-up analysis, Mathematical physics, Analytic basis of neural nets	Prof. ISHIWATA Michinori
	Statistical Science	Statistical Analysis Group	Sparse Estimation, Bayesian Networks, Machine Learning, Information Theory, Bioinformatics, Bayes Statistics, Information Geometry, Quantum Tomography	Prof. SUZUKI Joe
		Statistical Science Group	Multivariate analysis, Structural equation modeling, Statistical causal inference, Machine learning, selective inference, functional data analysis, fMRI data analysis, Cluster analysis, Visualization	Prof. KANO Yutaka
Mathematical Science for Social Systems	Mathematical and Statistical Finance	Research Group of Statistical Inference	Statistical inference for stochastic processes, High frequency data analysis, Actuarial mathematics, Statistical Seismology, Survival Analysis, Mathematical statistics, Fractional Brownian motion	Prof. UCHIDA Masayuki
		Research Group of Mathematical Modeling in Finance	Dynamic utility maximization, Stochastic optimal control, Dynamic programming equation, Insurance mathematics, Quantitative risk management, Mathematical Finance	Prof. SEKINE Jun
		Research Group of Stochastic Analysis	Stochastic integration, Stochastic (partial) differential equations, Fractional Brownian motion, Rough path analysis, Stochastic Quantization, (Quantum) Computational Finance, Stochastic numerical analysis	Prof. FUKASAWA Masaaki
	Theoretical Systems Science	Research Group of Complex Systems	System theory, Formal method, Discrete event system, Hybrid system, Cyber-physical system, Deep learning, Model-based machine learning, Reinforcement learning	Prof. USHIO Toshimitsu
		Research Group of Systems Optimization and Decision Making	Decision making, Systems optimization, Multiple criteria decision aiding, Fuzzy logic, Management of uncertanty, Data mining, Soft Computing, Rule induction	Prof. INUIGUCHI Masahiro

Special Program of "Engineering Science 21st Century"

Master's and Doctoral Courses in English

Contents of Study

The Graduate School of Engineering Science aims to acquire a strong international reputation through increased exchange of students and researchers, and in joint research projects. For this objective, the Graduate School of Engineering Science has decided to offer a new interdisciplinary program in which all lectures, as well as all instructions and supervision in research-related activities and seminars, are given in English. The students are not required to learn Japanese to join this program. In this program, globally recognized and highly qualified graduates are expected to be educated under the guiding principles of the Graduate School of Engineering Science: integrating science and technology.

Outline and Features of the Program

1) The aim of this program is to develop human resources with high level, creative and flexible problem-solving ability. This is achieved through multi- and interdisciplinary research training, seminars, and lectures, given by prominent professors in their respective fields.

2) Students are guided and supervised in English.

3) Students can select one of the **eleven "Divisions"** of the Graduate School of Engineering Science (see **Table 1**), for their research study for a Master's or Doctoral Degree. Students will be required to choose one professor as their supervisor.

4) The opportunity for an internship at a prominent Japanese company or research organization will be provided in order to increase the knowledge and experience of cutting-edge technologies. This internship will allow international students to become discerning and well-balanced scientists, with a deeper understanding of the Japanese society. The internship will also meet the requirements of those international students who wish to have practical experience in industry.

5) The program also provides the opportunity to enhance interactions between Japanese and international students. The program will improve the international awareness of Japanese students, as well as deepen international students' understanding of the Japanese society. This will also meet the demands of those Japanese students who want to work in the global environment.

Course Requirements

1) **Master's Course students** are required to obtain 30 credits, as given in **Table 2**. The list of lectures given in English is shown in **Table 3**.

2) **Doctoral Course students** are required to obtain 12 credits in "Advanced/Special Research I to VI" for each division as well as to take "Research Training for Doctor's Thesis" with no credit.

Table 1. Departments and Divisions of the Graduate School of Engineering Science

Department of Materials Engineering Science

Division of Materials Physics
- Area of Electron Correlation Physics
- Area of Quantum Physics of Nanoscale Materials
- Area of Quantum Materials Physics

Division of Chemistry
- Area of Synthetic Chemistry
- Area of Molecular Organization Chemistry
- Area of Solar Energy Chemistry

Division of Chemical Engineering
- Area of Chemical Reaction Engineering
- Area of Environment and Energy System
- Area of Bioprocess Engineering
- Area of Solar Energy Chemistry

Division of Frontier Materials Science
- Area of Frontier Materials
- Area of Dynamics of Nanoscale Materials
- Area of Quantum Science in Extreme Conditions

Department of Mechanical Science and Bioengineering

Division of Nonlinear Mechanics
- Area of Mechanics of Fluids and Thermo-fluids
- Area of Mechanics of Solid Materials

Division of Mechanical Engineering
- Area of Propulsion Engineering
- Area of Mechano-informatics

Division of Bioengineering
- Area of Biomechanical Science
- Area of Biophysical Engineering
- Area of Biomedical and Biophysical Measurements

Department of Systems Innovation

Division of Advanced Electronics and Optical Science
- Area of Solid State Electronics
- Area of Advanced Quantum Devices and Electronics
- Area of Optical Electronics
- Area of Advanced Electronics Under Extreme Conditions

Division of Systems Science and Applied Informatics
- Area of System Theory
- Area of Intelligent Systems

Division of Mathematical Science
- Area of Mathematical Modelling
- Area of Statistical Science

Division of Mathematical Science for Social Systems
- Area of Mathematical and Statistical Finance
- Area of Theoretical Systems Science

Table 2. Requirements for Master's Course

Category	Number of Credits
Lectures	18
Seminar I~IV in each division	4
Research I~IV in each division	8

Table 3. List of lectures of Master's Course

○=Annual classes * =Biennial classes

Lectures	Credits
Solid State Spectroscopy	2(○)
Science and Engineering of Correlated Electron Materials	2(○)
Introduction to magnetism and spintronics	2(○)
Advanced magnetism and spintronics	2(○)
Properties of Materials	2(○)
Bio-Inspired Chemical Engineering1	1(○)
Bio-Inspired Chemical Engineering2	1(○)
Molecular Nanotechnology	2(○)
Theoretical Materials Science	2(○)
Photophysics of Nanoscale Materials	2(○)
Frontier of Nano-scale Materials	2(○)
International Exchange Lecture on Nanoscience and Nanoengineering A	1(○)
International Exchange Lecture on Nanoscience and Nanoengineering B	1(○)
International Exchange Lecture on Nanoscience and Nanoengineering C	1(○)
Turbulence Dynamics	2(*)
Advanced Fluid Mechanics	2(○)
Advanced Experimental Mechanics	2(○)
Vibrations and Waves	2(*)
Topics in Multiphase Flow Engineering	2(*)
Topics on Robotics	2(*)
Stability Analysis of Dynamical Systems	2(○)
Advanced Theoretical Solid Mechanics	2(*)
Advanced Computational Mechanics	2(○)
Biomechanics	2(○)
Theory of Optimum Design and Synthesis	2(*)
Biomechanism	2(*)
Biomedical data science	2(*)
Biosystem Engineering	2(○)
Engineering in biology and medicine	2(*)

Lectures	Credits
Medical Virtual Reality	2(○)
Advanced Optoelectronics	2(○)
Adaptive Robotics	2(*)
Soft Robotics	2(○)
Signal Analysis Theory	2(○)
Theory of Systems Analysis	2(*)
Applied Robotics	2(*)
Intelligent Robotics	2(○)
Mixed Reality Systems	2(*)
Imaging Systems	2(*)
Database Systems	2(*)
Communication Robot	2(*)
Intelligent Learning System	2(*)
Mathematical Cognitive Systems	2(*)
Topics in Mathematical Sciences 1	1(*)
Topics in Mathematical Sciences 2	1(*)
Topics in Mathematical Sciences 3	1(○)
Topics in Mathematical Sciences 4	1(○)
Topics in Mathematical Statistics 1	1(*)
Topics in Mathematical Statistics 2	1(*)
Topics in Mathematical Statistics 3	1(○)
Topics in Mathematical Statistics 4	1(○)
Data Science and Case Studies I	2(○)
Nonlinear System Theory	2(○)
Systems Optimization and Analysis	2(*)
Intelligent Mathematical Programming System	2(○)
Introduction to Engineering Science	2(○)
Advanced Physical Chemistry	2(○)
Advanced Organic Chemistry	2(○)
Advanced Chemistry for Material Science	2(*)
Chemical Reaction Engineering	2(○)
Biochemical Materials Engineering	2(*)
Solid State Devices	2(○)
Opto- and Quantum Electronics	2(○)
Advanced Mathematical Science A	2(○)
Advanced Mathematical Science B	2(○)
Advanced Mathematical Science C	2(○)
Engineering Science Research Internship 1	1(○)
Engineering Science Research Internship 2	2(○)

Graduate School of Engineering Science

OSAKA UNIVERSITY

1. Message from the Dean

Aiming for further development of the School/ Graduate School of Engineering Science

The School/ Graduate School of Engineering Science has a unique philosophy of "Fundamentally developing scientific technology by a fusion of science and engineering will create the true culture of humanity." Based on this philosophy, we have always pioneered new academic fields. In other words, our motivation comes from the desire to develop education and research from the pursuit of the scientific principles, which is the basis of engineering, to their systematization and application to technological development, as well as interdisciplinary fusion. In addition, we have nurtured human resources with both scientific and engineering perspectives and have contributed to the development of modern society supported by the progress of science and technology.

"Engineering Science," which is the core name of our faculty and graduate school, is different from "Science and Engineering." It means not only deepening basic scientific principles but also fusing both science and engineering to create new research fields. We have extended this interdisciplinary fusion to the fields, such as life sciences, medicine, information sciences, humanities and social sciences, other than engineering and science. Sixty years after the faculty was founded in 1961, that effort flourished. Interdisciplinary fusion has come to be recognized as indispensable for the innovation of advanced science and technology and the solution of complex and diversifying social issues on a global scale. Therefore, expectations are rising for Engineering Science that enables deepening of scientific principles and interdisciplinary fusion. Currently, our graduate school is promoting original interdisciplinary research that will bring about future social changes. It includes the following: Material Creation, which fuses physics and chemistry; Spintronics, which brings about innovation of electronic devices; Quantum Computing, which leads to the next-generation computational science; Robotics, which aims for a symbiotic society of humans and intelligent systems; Bioengineering, which supports medical care and welfare; and Mathematical Data Science, which is the basis of utilizing information. These interdisciplinary studies also play a leading role in Osaka University, which has been certified as a designated national university aiming to create innovation.

Our Engineering Science consists of a faculty consisting of 10 courses in 4 departments, a graduate school consisting of 11 courses in 3 departments, and 5 affiliated research centers. Its strength lies in our educational foundation based on mathematics and information, physics, chemistry and biology as a background; furthermore, its organizational strength to create new interdisciplinary fusion fields by connecting research organizations covering various specialized fields, with research in different disciplines, and in an organizational culture that is not aware of the barriers between fields. As a result, unlike integrated education and research that simply combines advanced research fields, the knowledge gained through fusion is returned to basic and applied research in the specialized fields here, which deepens and creates new academic fields. Flexible thinking that is not bound by established academic fields is reflected in undergraduate and graduate education, and education for working adults. Engineering Science's education and research system has achieved cyclical development in this way, and has been built under the unchanging philosophy for more than half a century. We would like to continue to maintain this tradition and further to develop Engineering Science with the philosophy of creating the true culture of humanity by incorporating advanced research, scientific technology, and the needs of society that are advancing with the times.

Dean
Graduate School of Engineering Science,
Osaka University

2. Outline of the Graduate School of Engineering Science

In the modern world, progress in technology is founded on the achievements in science, and these advances must be supported by continually developing technology. Technology and science are thus tightly knit together. The necessity of reflecting on this situation in research and education, particularly at Osaka University which is located in a major industrial area, was emphasized by Dr. Kenjiro Shoda while he was president of the university. Plans were laid out by Dr. Shoda to establish a new school for this purpose, rather than to extend the School of Science and School of Engineering which had their own separate aims. Through his efforts and those of former university President Dr. Shiro Akabori, together with support from the industry in and outside of Osaka, the School of Engineering Science came into existence in April 1961, and the Graduate School of Engineering Science was opened in April 1964.

The School and Graduate School are unique in name and character in Japan. Their purpose is to develop scientists with a keen interest in practical technology and engineers with a firm grasp of the basic sciences, who may use their expertise to develop new technology.

In April 1997, the departments of the Graduate School of Engineering Science were reorganized by restructuring the old departments into four departments: "Physical Science", "Chemical Science and Engineering", "Systems and Human Science", and "Informatics and Mathematical Science".

In April 2002, some groups in "Systems and Human Science" and " Informatics and Mathematical Science"
moved to the newly founded graduate schools of Osaka University: Information Science and Technology, and Frontier Bioscience. They play important roles in education and research of these new areas.

In April 2003, Graduate School of Engineering Science was reorganized in order to create new research fields in the multi- and inter-disciplinary areas. The new Graduate School of Engineering Science has three departments: "Department of Materials Engineering Science" dealing with physical and chemical materials from a unified view point of materials science, "Department of Mechanical Science and Bioengineering" dealing with mechanical science and bioengineering from the view point of applied mechanics, and "Department of Systems Innovation" dealing with electronics, systems and mathematics from the view point of system creation.

3. Historical Sketch

School/Graduate School of Engineering Science
Established in

1961 — Department of Mechanical Engineering
Department of Chemistry
Department of Electrical Engineering
Common Chairs (Mathematical Science)

1962 — Department of Control Engineering
Department of Material Physics

1963 — Department of Chemical Engineering

1964 — Graduate School of Engineering Science
Mathematical Science Course
Physical Science Course
Chemical Science Course

1967 — Department of Biophysical Engineering

1970 — Department of Information and Computer Sciences

1992 — Department of Systems Engineering
(reorganized from Department of Control Engineering)

1996 — Department of Chemical Science and Engineering
(reorganized from Department of Chemistry and
Department of Chemical Engineering)
Department of Informatics and Mathematical Science

1997 — Department of Electronics and Materials Physics
(reorganized from Department of Electrical
Engineering and Department of Material Physics)
Department of Systems Science
(reorganized from Department of Mechanical
Engineering, Department of Systems Science and
Department of Biophysical Engineering)
Graduate School of Engineering Science was
reorganized as follows:
Department of Physical Science
Department of Systems and Human Science

2002 — Graduate School of Information Science and Technology
Graduate School of Frontier Bioscience

2003 — Graduate School was reorganized as follows
Department of Materials Engineering Science
Department of Mechanical Science and Bioengineering
Department of Systems Innovation

2014 — Center for Science and Technology under Extreme

Department of Information and Computer Sciences
(reorganized from Department of Information and
Computer Science and Common Chairs (Mathematical Science)
Graduate School of Engineering Science was
reorganized as follows:

Conditions
Center for Promotion of Advanced Interdisciplinary
Research
2016 — Center for Spintronics Research Network
2017 — Center for Industry-University Collaboration