

**2019 Engineering Science 21<sup>st</sup> Century Doctoral Course Program  
for Foreign Students with a MEXT Scholarship**

July 2018

**Graduate School of Engineering Science, Osaka University**

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Website URL: <http://www.es.osaka-u.ac.jp/en/programs/admissions.html>



# 2019 Engineering Science 21<sup>st</sup> Century Doctoral Course Program for Foreign Students with a MEXT Scholarship

Graduate School of Engineering Science, OSAKA UNIVERSITY

The Osaka University Graduate School of Engineering Science features one of our MEXT-granted programs: “Special Training Program for Robotics Engineers” in English, starting in October 2019.

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 building up future Robotics industries in their mother countries as well as promoting close cooperation with the Japanese industry, academia, and government internationally.

The detailed application guide is as follows.

Note: MEXT (the Ministry of Education, Culture, Sports, Science and Technology of the Japanese Government)

## 1. Admission Capacity

### Doctoral Course Only

Three students in total for three departments below

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

Research areas and topics are found at the website: <http://www.es.osaka-u.ac.jp/en/research/>

## 2. Application Requirements

- (1) Nationality: The applicant’s nationality must be of a country that has diplomatic relation 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 must have been born on or after April 2, 1983. However, persons who have completed Young Leaders Program are eligible to apply as long as they enter to the doctoral program.
- (4) Applicants are required to have fulfilled at least one of the following items:
  - A 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 a 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 having research ability by referring their research achievement as equivalent to Master’s degree level by the Graduate School of Engineering Science, Osaka University; or
    - (c) is approved as an equivalent academically 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 is above 79 for TOEFL-iBT, 213 for TOEFL-CBT, 550 for TOEFL-PBT, 6.0 for IELTS or equivalent.

- (6) Health: Applicants must be in good health, and free of infectious diseases.
- (7) Attendance availability: Applicants should arrive in Japan immediately prior to the date of enrollment and start the course on the date of enrollment.
- (8) 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 the return home, and cooperating with all relevant projects and events conducted by Japanese diplomatic missions in the applicant's home country.
- (9) Notes on ineligible applicants:
  - (a) Members of the armed forces
  - (b) The applicant who is a previous recipient of a Japanese government (MEXT) scholarship, but does not have educational research experience exceeding more than three years from the first day of the month following the final payment of the previous scholarship to the beginning of the payment of this scholarship. 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 like teacher studies scholarships 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 program 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, 2019 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)-(b), (c) 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-daiakuin@office.osaka-u.ac.jp](mailto:ki-daiakuin@office.osaka-u.ac.jp)) to inquire about the necessary procedures.

### 4. Application Procedure

- (1) Application Period:

**Monday, November 19, 2018, to Friday, November 30, 2018**

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 is adequately fitting to his/her laboratory. The research topics of faculty members of the Graduate School of Engineering Science can be found in the attached list and are also available at the following website:

<http://www.es.osaka-u.ac.jp/keywords.pdf>

(2) Application Procedure:

Application documents should be submitted by a registered *postal* mail such as Express Mail Service (EMS) so that they should arrive within the application period to the address:

Graduate Students Section  
Graduate School of Engineering Science, Osaka University  
1-3 Machikaneyama, Toyonaka, Osaka 560-8531 JAPAN  
Fax: +81-6-6850-6151

No application will be accepted, if the documents are incomplete. Contents submitted cannot be changed, once the application procedure is completed. If any of application documents are falsified, admission will be cancelled even after enrollment.

(3) Application documents:

All the application documents (a)-(i) must be carefully completed in English typed/printed or written in block letters on A4- or US letter-sized white papers. Official English translation must be attached for every formal document given in other languages. No application documents are returnable.

- (a) Form “Application for Admission in 2019 Engineering Science 21<sup>st</sup> Century 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 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 officials of the graduate school.
- (e) Academic records, which also indicate the GPA or its equivalent and its full score, issued and signed by officials of the graduate school
- (f) Certificate of citizenship or a copy of the applicant’s passport on an A4- or US letter-sized paper.
- (g) Score report (original copy) of the TOEFL test or equivalent as a certificate of English proficiency except for the cases below.
  - Applicants whose first language is English.
  - Applicants who have graduated from a graduate school located in an English speaking country.
  - Applicants who have completed a graduate 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 instruction and examination.
- (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 of 3.2 by 2.6 cm in size
  - In 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 without hat/cap
  - Write your name and nationality in block letters on the back of all photos
  - Clip the photos on the form “Application for Admission in 2019 Engineering Science 21<sup>st</sup> Century Doctoral Course Program for Foreign Students with a MEXT Scholarship” (Do not paste.)

## 5. Screening

- (1) **First screening:** Screening of applicants will be made on the basis of the application documents by the Graduate School of Engineering Science, Osaka University within the month of December. An interview and academic examination will be conducted for those who have passed the initial application document screening within the month of January.
- (2) **Second screening:** MEXT will decide the recipients of the MEXT Scholarship from the recommended preliminary candidates selected by the Graduate School of Engineering Science, Osaka University.

## **6. Notification of Results**

The result of first screening will be mailed to the applicants by the end of March 2019.

The result of second screening will be mailed to the applicants at the beginning of July 2019.

Inquiry about the results by telephone etc. is strictly prohibited.

## **7. Date of Enrollment to the Course**

**October 1<sup>st</sup>, 2019**

## **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. Note**

- (1) Applicants are recommended to become well acquainted with the Japanese language, culture, custom, 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 middle of February 2019.
- (3) The MEXT Scholarship shall be provided in accordance with the rules set forth by the Japanese Government.

## **10. Requests for Application Forms**

Application forms will be downloaded from the website:

<http://www.es.osaka-u.ac.jp/en/programs/admissions.html>

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

Graduate Students Section

Graduate School of Engineering Science, Osaka University

1-3, Machikaneyama, Toyonaka, Osaka 560-8531 JAPAN

Fax: +81-6-6850-6151

Email: [ki-daigakuin@office.osaka-u.ac.jp](mailto:ki-daigakuin@office.osaka-u.ac.jp)

Application for Admission  
in  
2019 Engineering Science 21<sup>st</sup> Century Doctoral Course Program  
for Foreign Students with a MEXT Scholarship

Graduate School of Engineering Science, OSAKA UNIVERSITY

- Applicants must type or write clearly in English **block letters**.
- Numbers must be written in **Arabic numerals**.
- Years must be written in the **A.D. system**.
- Proper nouns must be written **in full and not be abbreviated**.

**I. Applicant**

Full Name	_____ , _____			
	Family name	First name	Middle name	
Date of Birth	_____	_____	_____	Nationality
	Year	Month	Day	Sex <input type="checkbox"/> Male <input type="checkbox"/> Female
Postal Code and Mailing Address				
Fax number	+( )	Phone Number	+( )	
E-mail addresses	@ @			

(1) Where is your place of birth? Include both the city and country in which you were born.

City: \_\_\_\_\_ Country: \_\_\_\_\_

(2) Have you been to Japan before? If yes, how many times did you come to Japan?

Yes          Time(s) \_\_\_\_\_  
 No

(3) Do you have a passport?

Yes          a) Number \_\_\_\_\_  
b) Date of issue (yyyy/mm/dd) \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
c) Date of expiration (yyyy/mm/dd) \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
d) Issuing authority \_\_\_\_\_

No

(4) Do you have family (father, mother, spouse, son, daughter, etc.) in Japan?

Yes           No

(5) Are you a scholarship holder?

Yes           No

If yes, write the name and terms of the scholarship. (attach a copy of the certificate)

Name of the scholarship: \_\_\_\_\_

Terms (yyyy/mm/dd): from \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ to \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

**II. Preferred course/department, and language proficiency**

(1) Department (check one)

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

(2) Supervisor and Division (please specify)

Professor \_\_\_\_\_  
 Division of \_\_\_\_\_

(3) Language proficiency

(a) English

• TOEFL (Test of English as a Foreign Language)

TOEFL-iBT     TOEFL-CBT     TOEFL-PBT  
 Score: \_\_\_\_\_ Date of Examination: \_\_\_\_\_

• If you have a score of other test, please specify.

Test name: \_\_\_\_\_  
 Score: \_\_\_\_\_ Date of Examination: \_\_\_\_\_

(b) Japanese

Excellent     Good     Fair     Poor

Attach a copy of a certificate of Japanese, if you have.

**III. Education and employment records**

(1) **Educational Background:** (State in detail your academic background)

	Name of school (City, Country)	Required years	Year and month (yyyy/mm) of entrance and completion	Degree
Elementary Education Elementary School			from  to	/
Secondary Education Junior High School  Senior High School			from  to  From  to	
Higher Education Undergraduate Level (GPA: . )  Graduate Level			from  to  from  to	
For Higher Education, School/Graduate School as well as University must be specified.				

**Total years of education as listed above: \_\_\_\_\_ years \_\_\_\_\_ months**



(2) **Record of Employment:** (Begin with the most recent one.)

Name of Employer	Period of Employment	Position	Type of Work

**IV. Application for Admission**

To the President of Osaka University

I understand and accept all the matters stated in the Application Guide, and hereby submit my application to apply for the Graduate School of Engineering Science, Osaka University as an international student of Doctoral Course for October 2019.

Date of application (yyyy/mm/dd): \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

Applicant's signature: \_\_\_\_\_

Applicant's name in English block capital: \_\_\_\_\_



## Details of Proposed Study

State the details of your major field of study and study plan in about 2,000 words.

Please note that this will be used as one of the most important references for selection.

### Instructions

1. Applicant must type or write clearly in English block letters.
2. Numbers must be written in Arabic numerals.
3. Years must be written in the A.D. system.

Name of Applicant:



## Abstract of Master's Thesis

State the abstract of applicant's Master's thesis or equivalent in less than 2,000 words.

Name of Applicant:



**Department of Materials Engineering Science**

Division	Area	Research Group	Keywords	Professor	
<b>Materials Physics</b>	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 processing, Entanglement manipulation, Quantum optics, Atom Optics, Optomechanics		
		Group for Exploration of Functional Materials	Magnetism, Ferroelectricity, Correlated electron systems, Oxides, Crystal growth		
	Quantum Materials Physics	Experimental Research Group for Nanoscience	Nanostructures, Spintronics		Prof. SUZUKI Yoshishige
	Condensed Matter Theory	First-principles calculation, Condensed matter theory, Materials prediction and design, Magnetism, Ferroelectricity, Superconductivity, Multiferroics		Prof. OGUCHI Tamio	
<b>Chemistry</b>	Synthetic Chemistry	Synthetic Organic Chemistry Group	Environmentally benign process for molecular transformations, Simulation of enzymatic functions with metallo- and organocatalysts, Creation of functional organometallics	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 Organization Chemistry	Surface Chemistry Group	Energy Conversion, Electrode Interfaces, Ionic Liquid Interfacial Chemistry, Catalytic Reaction Mechanism, Electron Transfer at Interfaces	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	Light-to-chemical energy conversion; Photofunctional materials; Photoelectrocatalysts; Electrocatalytic reactions; Photosynthesis	Prof. NAKANISHI Shuji	
<b>Chemical Engineering</b>	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	
		High-Performance Catalyst Group	Green Chemistry, Environmentally-benign organic synthesis, Inorganic crystallites, Dendrimer, Nanocluster	Prof. JITSUKAWA Koichiro	
	Environment and Energy System	Transport Phenomena Control Group	Control of Heat and Mass Transfer, 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	
		Bioreaction Engineering Group	Bioprocess, Bioreactor, Gene/metabolic Engineering, Tissue Engineering, Environment Bioengineering	Prof. TAYA Masahito	
		Biochemical Materials Engineering Group	Biomedical, Biomaterial, Tissue fabrication, Hydrogel, Soft matter, Biochemical engineering	Prof. SAKAI Shinji	
	Solar Energy Chemistry	Environmental Photochemical Engineering Group	Photocatalysts, Highly Selective Transformation of Organic Compounds, Artificial Photosynthesis, Photoluminescent Molecular Devices and Sensors	Prof. HIRAI Takayuki	
<b>Frontier Materials Science</b>	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	
		Theory Group of Advanced Materials Science	Microscopic theory of light-matter interaction, Photo-functional design with nano-materials, Optical manipulation of nanostructures, Theory of nonlinear optical response of solids (Elucidation and prediction of new phase of matters under extreme conditions, The first-principles calculations and its development based on the quantum simulation)	Prof. ISHIHARA Hajime (Assoc. Prof. KUSAKABE Ko-ichi)	
	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	

**Department of Mechanical Science and Bioengineering**

Division	Area	Research Group	Keywords	Professor
<b>Nonlinear Mechanics</b>	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	Strength of Structure and Materials Group	Dynamic behavior of materials and structure, Biomimetics of plants, Hydrogen embrittlement of metals, Mechanical properties of functional materials, Development of new structural materials	Prof. KOBAYASHI Hidetoshi
		Solid Mechanics Group	Theory of nonlinear and nonlocal elasticity, Extended isogeometric analysis, Stress field analysis, Lattice defects, Resonant ultrasound spectroscopy, Dynamics of colloidal materials, Gas sensor	Prof. TARUMI Ryuichi
<b>Mechanical Engineering</b>	Propulsion Engineering	Molecular Fluid Dynamics Group	Molecular fluid dynamics for life science, environmental technology, and space engineering. Nanoscale medical device, Numerical design of next-generation battery, Atmospheric flow on planets, Micro/nanoscale multiphase flow, Coexistence of flow field and fluctuation, Ionic current, Non-equilibrium gas flow	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	Robotics and Mechatronics Group	Human-Robot Interface, Analysis of Human Movements, Human-like Musculoskeletal Robots, Human Skills Transfer to Robots, Robotic Orthosis, Assistance System for Single-Incision Laparoscopic Surgery	
		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, Structural materials with high strength and ductility, Nanostructured Materials, Amorphous materials, Nano-Materials	Prof. OGATA Shigenobu
<b>Bioengineering</b>	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	Prof. TANAKA Masao
		Biomechanical/physical informatics Group	Health Engineering, Human Stress Sensing/Control, Bio-signal, Biomarker, Early Detection of Disease, Lipid Peroxidation	Guest Prof. YOSHIDA Yasukazu
	Biophysical Engineering	Bio-Dynamics Group	Nonlinear dynamical system theory and its application to biology, Human motor control, Posture and Gait, Biological rhythms, Cardiac arrhythmias, Systems physiology, Biosignal processing, Homeodynamics, Bio-big data analysis	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	Physical/biochemical properties of cells and subcellular components, Bioengineering-based drug repositioning, Cellular adaptation to mechanical environment, Biomechanical mechanisms of animal vocalization, Microfluidics, Tissue engineering	Prof. DEGUCHI Shinji
		Bioimaging Group	Biomedical measurement, Medical image, CG, Visualization, Display system, VR, Haptic rendering, Human-computer interaction, Communication, Information sharing, Physics-based simulation, Complex Space	Prof. OSHIRO Osamu



**Department of Systems Innovation**

Division	Area	Research Group	Keywords	Professor
<b>Advanced Electronics and Optical Science</b>	Solid State Electronics	Nanoelectronics Group	Group-IV semiconductor materials, Nitride semiconductor materials, Nanodots, Functional memory devices, Thermoelectric devices, Synchrotron radiation X-ray microdiffraction, Transmission electron microscopy	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, Flexible electronics	Prof. HAMAYA Kohei
	Advanced Quantum Devices and Electronics	Advanced Quantum Device System Group	Nuclear quadrupole resonance (NQR), Mine detection, Baggage inspection, Nondestructive Evaluation, Superconducting interference device (SQUID), High temperature superconducting electronics	Prof. KITAGAWA Masahiro
		Advanced Quantum Information Device Group	Quantum computers, Quantum information, Nuclear magnetic resonance (NMR), Electron spin resonance (ESR)	
	Optical Electronics	Microwave Photonics Group	Artificial metamaterials, Transformation optics, Invisibility cloaks, Photonics crystals, Microwave photonics, Integrated optical circuits, Optical modulators, Optical measurements, Optical scattering	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	Laser cooling, Quantum information, Quantum optics, Ion trap, Laser stabilization, Frequency standard	Prof. MUKAIYAMA Takashi
	Advanced Electronics Under Extreme Conditions	Advanced Electronics Group	Atom technology, Nanobiology, Nanoelectronics, Scanning Probe Microscopy, Medical Engineering, Nanometer analysis and characterization	Prof. ABE Masayuki
<b>Systems Science and Applied Informatics</b>	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	Signal Analysis, Systems Analysis, Adaptive System, Noise suppressor, Image interpolation, Feature extraction	Prof. IIGUNI Youji
	Intelligent Systems	Applied Robotics Group	Robot Mechanism, Robot Vision, Ambient Intelligence, Nano-Micro Robotics, Humanoids & Multi-Legged Robots, Safety & Security Robotics, Human Robot Interaction	Prof. ISHIGURO Hiroshi
		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	
		Pattern Measurement Group	Vision Sensing, Image Engineering, 3D Measurement, Intelligent Sensing, Digital Archives, Augmented Reality, Mixed Reality, Human Interface	
		Robotic Manipulation Research Group	Robot Manipulator, Motion Planning, Assembly, Human-Computer Interaction, Social Computing, Augmented Reality	
<b>Mathematical Science</b>	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, Nonlinear differential equations, Variational methods, Dynamical systems, Blow-up analysis, Mathematical physics, Critical phenomena	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, information loss, time series analysis, model selection	Prof. KANO Yutaka
<b>Mathematical Science for Social Systems</b>	Mathematical and Statistical Finance	Research Group of Statistical Inference	Statistical inference for stochastic processes, High frequency data analysis, Actuarial mathematics, Monte Carlo methods, Bayesian Statistics, Mathematical statistics, machine Learning, fMRI data analysis, Network data analysis	Prof. UCHIDA Masayuki
		Research Group of Mathematical Modeling in Finance	Long-term optimal investment, Dynamic portfolio selection, Asset price modeling, Stochastic control, Differential games, Dynamic programming equations, Optimal execution, Liquidity problem, Quantitative risk management	Prof. SEKINE Jun
		Research Group of Stochastic Analysis	Stochastic integration, Stochastic differential equations, Fractional Brownian motion, Rough path analysis, Mathematical finance, Quantitative Finance, Computational finance, Financial engineering	Prof. FUKASAWA Masaaki
	Theoretical Systems Science	Research Group of Complex Systems	System theory, formal approach, discrete event system, hybrid system, multi-agent system, nonlinear system, evolutionary game, reinforcement learning	Prof. USHIO Toshimitsu
		Research Group of Systems Optimization and Decision Making	Decision making, Systems optimization, Combinatorial optimization, Multiple criteria decision aiding, Fuzzy-logic, Data mining, Supply chain management, Computational Intelligence	Prof. INUIGUCHI Masahiro



# Special Program of “Engineering Science 21<sup>st</sup> Century”

## Master’s and Doctoral Courses in English

### Study Contents

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 or associate 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**. Students can also have internship training at a Japanese company or research organization.

2) **Doctoral Course students** are required to take “Research Training for Doctor's Thesis” and to obtain 12 credits, as in **Table 4**.

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(○)
Advanced Physical Chemistry	2(○)
Advanced Organic Chemistry	2(○)
Advanced Chemistry for Material Science	2(○)
Bio-Inspired Chemical Engineering	2(○)
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(*)
Viscous Fluid Mechanics	2(*)
Strength of Structure	2(*)
Ultrasonic Techniques	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(*)

Lectures	Credits
Biosystem Engineering	2(O)
Engineering in biology and medicine	2(*)
Medical Virtual Reality	2(*)
Quantum Information Science	2(*)
Advanced Optoelectronics	2(O)
Systems and Control Theory	2(*)
Adaptive Systems Theory	2(*)
Signal Analysis Theory	2(*)
Theory of Systems Analysis	2(*)
Applied Robotics	2(*)
Intelligent Robotics	2(*)
Mixed Reality Systems	2(*)
Advanced Robot Systems	2(*)
Imaging Systems	2(*)
Database Systems	2(*)
Communication Robot	2(*)
Topics in Mathematical Sciences I	2(*)
Topics in Mathematical Sciences II	2(*)
Topics in Mathematical Statistics I	2(*)
Topics in Mathematical Statistics II	2(*)
Data Science and Case Studies I	2(O)
Nonlinear System Theory	2(O)
Systems Optimization and Analysis	2(*)
Intelligent Mathematical Programming System	2(*)
Introduction to Engineering Science	2(O)
Material Process Engineering	2(*)
Bioreaction Engineering	2(*)
Solid State Devices	2(O)
Opto- and Quantum Electronics	2(O)
Advanced Mathematical Science A	2(O)
Advanced Mathematical Science B	2(O)
Advanced Mathematical Science C	2(O)
Engineering Science Research Internship	2(O)

**Table 4. Requirements for Doctoral Course**

Category	Number of Credits
Research Training for Doctoral Thesis	Nil
Advanced/Special Research I ~VI	12

**Graduate School of Engineering Science  
OSAKA UNIVERSITY**

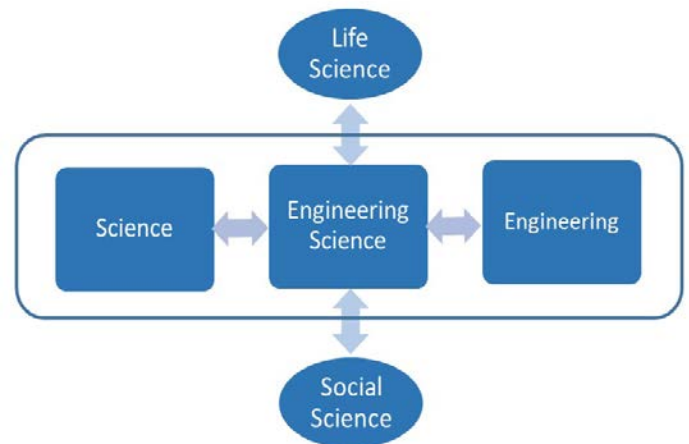
## 1. Message from the Dean

Welcome to the Graduate School of Engineering Science/School of Engineering Science, Osaka University

As we well know, science and engineering had developed tremendously during the 20th century, so that subsequently our lives have been changed and improved drastically. The extension and formalization of the fundamental disciplines and their applications to manufacturing played an important role of the developments. We believe that fusing together as well as developing the fundamental disciplines are necessary steps toward continuing to contribute to developments in the future. In addition, we incorporate the fruits from humanity and social science research with those from science and engineering in order to create true culture of the human being.

Since the foundation of the School of Engineering Science in 1961, we have continuously created interdisciplinary research fields congruent with social needs and have made a great contribution to the academy and industry through research and education. Osaka University offers great and unique opportunities of education and research in the wide range of the fields of basic science, engineering science and manufacturing. In addition, our graduate school attempts to connect life science with the engineering science and further progress toward the integration of arts and science, which includes financial engineering and insurance, robotics and data science.

In the School of Engineering Science, which has ten courses, we have organized a characteristic curriculum for each course to provide a deep knowledge of basic subjects, such as mathematics, physics, chemistry, biology and informatics, as well as major important subjects related to the courses. Our education also develops wider viewpoints and flexibility. In the Graduate School, with eleven divisions, we provide higher-level professional education and perform fusion research with the different areas. We attempt to produce graduates who have a firm specialty and the potential to pursue research and development in areas beyond their acquired specialty.



Dean  
Graduate School of Engineering Science,  
Osaka University

*Yutaka Kano*

## 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 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:

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



## Special Program of “Engineering Science 21<sup>st</sup> Century” In English Graduate School of Engineering Science, Osaka University

