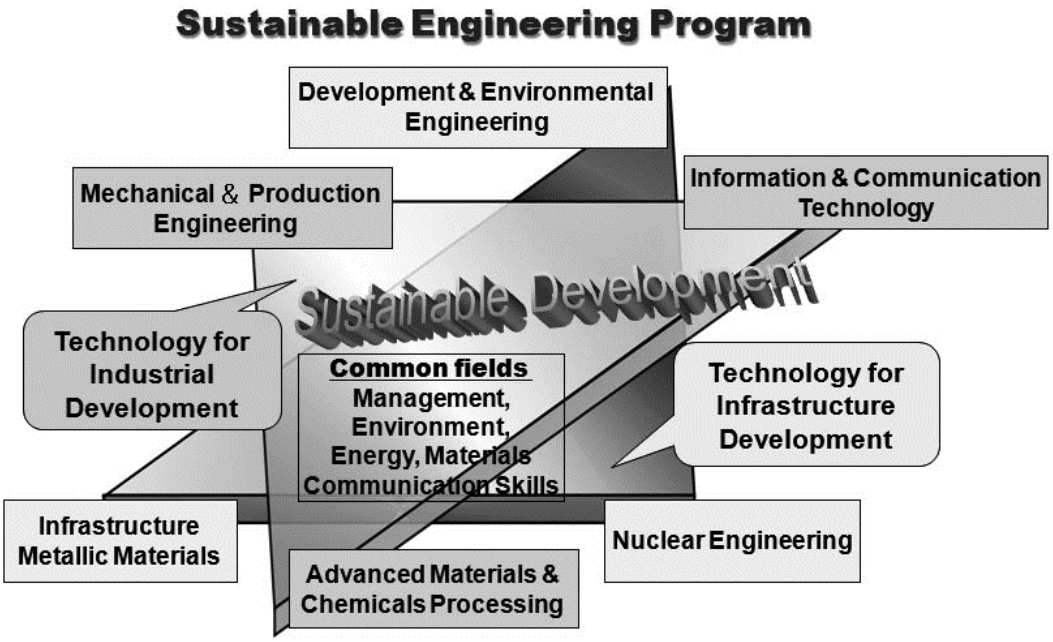
International Graduate Program (IGP-A)

◆ Sustainable Engineering Program

1. Program Outline

Sustainable Engineering Program (SEP) aims to train "highly educated, internationalized engineers" having a wide spectrum of technical knowledge from fundamentals to their applications. Degree recipients in this program are expected to participate as leaders in international projects, such as overseas deployments by Japanese companies and development projects by international organizations, with creative and innovative manners in the related fields. SEP consists of six special courses as fundamental disciplines in Sustainable Engineering aiming at the sustainable society and development as shown in the figure below. The student will be enrolled in a special course and educated in Integrated Doctoral Education Program, in which they are expected to study from Master's to Doctoral programs continuously for the both degrees.



2. Special Course Outlines and Faculty

Six special courses fall into two groups: One focuses on the technology for infrastructure development, the other on the technology for industrial development. Each course consists of several departments, which are closely related to the objectives of the course. Course outlines as well as departments and faculty members involved in the courses are given in order as below.

Technology for Infrastructure Development

2.1 Development and Environmental Engineering Course

Construction, maintenance and renewal of various infrastructures are of vital importance in every nation for developing all types of industry and creating secure and firm built environments. Infrastructure developments have been carried out as a national or an international project under various environments, such as natural, social, economic and human environments. Therefore the infrastructure development harmonized with the environments is crucial to sustainable development of society and industry. This course based on Civil and Environmental

Engineering, and International Development Engineering aims its mission to train creative engineers and scientists. The graduates of this course are expected to play pivotal roles in various projects, e.g., infrastructure development, resource development and environment preservation projects, as a leading engineer or a project manager.

Dept. of International Development Engineering

Professors:

OTSUKI, Nobuaki, D. Eng.	Construction Materials
HINODE, Hirofumi, D. Eng.	Inorganic Materials and Properties, Catalyst and Chemical, Process, Chemical Engineering in General
TAKADA, Jun-ichi, D. Eng.	Wireless Communications, ICT and Development
KANDA, Manabu, D. Eng.	Regional Atmospheric Environment
TAKAHASHI, Kunio, D. Eng.	Mechanics, Welding and Joining, Tribology, Energy Harvesting
NAKASAKI, Kiyohiko, D. Eng.	Environmental Bioengineering
YAMAGUCHI, Shinobu, Ph. D.	Education and IT, International Development and Cooperation, Sustainable Development of World Cultural Heritage

Associate Professors:

ABE, Naoya, Ph. D.	Environmental Information, Policy and Management, Applied Economics, International Cooperation
HANAOKA, Shinya, D. Info. Sci.	Transport Planning, Logistics, Transport Project Management
YAMASHITA, Yukihiko, D. Eng.	Computer Science, Intelligent Informatics
TAKAGI, Hiroshi, D. Eng.	Disaster Prevention Engineering, Coastal Engineering
EGASHIRA, Ryuichi, D. Eng.	Separation Engineering, Separation Process, Separation Operation
AKITA, Daisuke, D. Eng.	Fluid Dynamics, Aero-space engineering

Dept. of Civil Engineering

Professors:

NIWA, Junichiro, D. Eng.	Structural Concrete
ASAKURA, Yasuo, D. Eng.	Traffic and Transport Engineering
KITAZUME, Masaki, D. Eng.	Geotechnical Engineering, Ground Improvements
HIROSE, Sohichi, D. Eng.	Applied Solid Mechanics
ISHIKAWA, Tadaharu, D. Eng.	Environmental Hydraulics
NADAOKA, Kazuo, D. Eng.	Coastal Environment and Ecosystem Conservation
YAI, Tetsuo, D. Eng.	Transportation Planning & Engineering
MORIKAWA, Hitoshi, D. Eng.	Earthquake Engineering
IWANAMI, Mitsuyasu, D. Eng.	Maintenance Engineering
KANAE, Shinjiro, D.Eng.	Hydrology, Water resources
KINOUCHI, Tsuyoshi D.Eng	Water Control Science, Hydrology

Associate Professors:

TAKEMURA, Jiro, D. Eng.	Soil Mechanics & Geo-environmental Engineering
WIJEYEWICKREMA, C. Anil, Ph. D.	Structural Engineering, Earthquake Engineering, Solid Mechanics
FUKUDA, Daisuke, D.Eng.	Transportation and Infrastructure Planning
TAKAHASHI, Akihiro,D.Eng.	Geotechnical Engineering
YOSHUMURA Chihiro, D. Eng.	Environmental Engineering, Biogeochemistry, Aquatic Ecology
SASAKI, Eiichi, D. Eng.	Bridge Engineering, Fracture Control & Structural Monitoring

SAAVEDRA V, Oliver. C, Ph.D	Hydrology, Water Resource Management
MUROMACHI, Yasunori, D. Eng.	Urban Transportation Planning
NAKAMURA, Takeshi, D. Eng.	Numerical Fluid Mechanics

2.2 Nuclear Engineering Course

Growing attention has been again placed on nuclear energy as an ultimate measure for reduction of fossil fuel consumption and CO_2 emission. Under the circumstances of global warming and the price hike of oil, gas and coal, a number of countries have been considering the implementation of nuclear power plants. The key factor of the nuclear energy development is the development of human resources. Our original course of international nuclear engineering has been established in 1993. Since then, a number of students have joined us from many different countries and graduated from our course. They are actively contributing to the development of industries and technologies in their own countries. This graduate course provides with core curriculum for nuclear reactor engineering and fuel cycle technologies and also covers extended nuclear energy, such as beam, accelerator, plasma sciences, nuclear fusion, energy and environment, and social relations.

Dept. of Nuclear Engineering

Professors:

YANO, Toyohiko, D. Eng.	Nuclear Reactor Materials, Radiation Damages, Ceramic Matrix Composites
AOKI, Takayuki, D. Sc.	Large-scale Computational Fluid Dynamics, HPC Grid Application, Computational Physics and Engineering, Global Environmental, Simulation, Computational Medicine
IGASHIRA, Masayuki, D. Eng.	Neutron Physics, Nuclear Transmutation, Nuclear Physics
IKEDA, Yasuhisa, D. Eng.	Radioactive Waste Management, Radiopharmaceuticals Actinide Chemistry, Nuclear Fuel Reprocessing, Nuclide Partitioning, Green Chemistry (Supercritical Fluids, Ionic Liquids)
TAKESHITA, Kenji, D. Eng.	Nuclear Chemical Engineering, Nuclear Fuel Cycle, Nuclear Fuel Reprocessing, Nuclide Separation (MA, Cs, Sr, Tc, PGM), Isotope Separation, Metal Recycling
OZAWA, Masaki, D. Eng.	Spent Fuel Reprocessing, PUREX Process Chemistry, Partitioning &Transmutation, Nuclear Rare Metals, Nuclear Security
OGURI, Yoshiyuki, D. Eng.	Heavy Ion Inertial Fusion, Accelerator-based Environmental and Medical Sciences
CHIBA, Satoshi, D. Eng.	Nuclear Reactions, Nuclear Decay, Nuclear Data, Radiation Transport, Innovative Nuclear Systems, Medical and Astrophysical Applications
OBARA, Toru, D. Eng.	Reactor Physics, Nuclear Reactor Design, Direct Energy Conversion
TAKAHASHI, Minoru, D. Eng.	Light Water Reactor and Fast Reactor Engineering, Thermal Hydraulics, Nuclear Material, Fusion Reactor Blanket, Liquid Metal Engineering

Associate Professors:

KATO, Yukitaka, D. Eng.	Energy Conversion, Energy Storage, Chemical Heat Pump,

	Hydrogen Energy, Fuel Cell, Zero-emission Energy System
AKATSUKA, Hiroshi, D. Eng.	Plasma Diagnostics, Plasma Spectroscopy, Laser Engineering, Atomic and Molecular Processes in Plasmas
IIO, Shunji, D. Sc.	Plasma Physics, Fusion Engineering, Laser Diagnostics
MATSUMOTO, Yoshihisa, PhD.	Radiation Biology, Molecular Biology and Biochemistry, Basic Medicine
KIKURA, Hiroshige, D. Eng.	Nuclear Reactor Safety, Process Control and Measurement System, Safe Transport of Radioactive Material
HAYASHIZAKI, Noriyosu, D. Eng.	Accelerator Physics and Engineering, Particle Beam Simulation, Accelerator-Based Boron Neutron Capture Therapy
TSUKAHARA, Takehiko, D. Eng.	Nuclear Fuel Cycle, Nuclear Waste Management, Micro/Nano technologies, Functional Materials
TSUTSUI, Hiroaki, D. Eng.	Plasma Physics and Nuclear Fusion, Superconducting Magnetic Energy Storage system
SAGARA, Hiroshi, D. Eng.	Nuclear Safety, Security, Safeguards, Non-proliferation

2.3 Infrastructure Metallic Materials Course

Steel making industries and other metalworking industries play important roles in advancing civilized society because they are producing all kinds of infrastructure metallic materials to be used for other industries such as construction, civil, mechanical, automobile and electronic industries. Therefore, metallurgical engineering is one of the important basic academic/engineering fields for industrialization of developing countries. This graduate course is, thus, designed for those who want to be a pillar of metalworking industries in developing countries. The course provides both fundamental and applied metallurgy and covers all subjects of metallurgy based on the following three categories: metal physics, metal chemistry, and materials metallurgy.

Dept. of Metallurgy and Ceramics Science (Metallurgy Group)

Professors:

SUSA, Masahiro, D. Eng.	Physical Chemistry of Metals, Materials Metrology
NAKAMURA, Yoshio, D. Eng.	Applied Diffraction Crystallography, Nano-Structured Material
*NISHIKATA, Atsushi, D. Eng.	Metallurgical Electrochemistry, High Temperature Electrochemistry, Corrosion
TAKEYAMA, Masao, D. Eng.	Physical Metallurgy of Intermetallic and Ferrous Materials, Phase Transformations of Alloys, Deformation in Solid
SHI, Ji, D. Eng.	Physical Properties of Metals, Magnetic Thin Films
FUJII, Toshiyuki, D. Eng.	Crystallography of Microstructures
KUMAI, Shinji, D. Eng.	Mechanical Metallurgy, Fatigue, Joining and Solidification

*Dept. of Chemistry and Materials Science

Associate Professors:

KAWAMURA, Kenichi, D. Eng.	High Temperature Physical Chemistry, Solid State Ionics
KOBAYASHI, Equo, D. Eng.	Metallurgy of Non-ferrous Metals and Alloys, Phase Stability, Biomedical Materials, Standardization of Medical Devices
KOBAYASHI, Yoshinao, D. Eng.	High Temperature Thermodynamics , Metal Refining
HAYASHI, Miyuki, D. Eng.	Thermophysical Properties of Materials, High Temperature Process Control
UEDA, Mitsutoshi, D. Eng.	High Temperature Oxidation of Metals, Defect Chemistry in Oxides, Physical Chemistry at High Temperature

HAYASHI, Shigenari, D.Eng.	High Temperature Materials Chemistry, High Temperature Oxidation and Corrosion, Coating
*TADA, Eiji D. Eng	Corrosion and Environmental Degradation of Materials

*Dept. of Chemistry and Materials Science

Dept. of Materials Science and Engineering

Professors:

KATO, Masaharu, D. Eng.	Physical and Mechanical Metallurgy
ONAKA, Susumu, D. Eng.	Mechanical Properties of Materials
SATO, Tatsuo, D. Eng.	Metallurgy of Non-ferrous Metals and Alloys, Phase Transformation of Alloys, Solidification
KAJIHARA, Masanori, D. Eng.	Thermodynamics and Kinetics

Associate Professors:

KIMURA, Yoshisato, D. Eng.	Microstructure Control and Characterization of Intermetallic Alloys
SONE, Masato, D. Eng.	Micro/Nano Materials Engineering & Science
TERADA, Yoshihiro, D. Eng.	Microstructure Control, Mechanical Propeerties, Heat-Resistant Materials

Dept. of Innovative and Engineered Materials

Professor:

HOSODA, Hideki, D. Eng.	Materials Design, Shape Memory Alloys, Intermetallic Compounds

Associate Professor:

INAMURA, Tomoya, D. Eng.	Shape Memory Alloy, Crystallography of Phase Transformation

Technology for Industrial Development

2.4 Mechanical and Production Engineering Course

Mechanical and Production Engineering is a foundation of an advanced industrial nation and a key technology for the industries such as automobile, electrical and electronic products, precision instruments and robotics. To learn and master the ability of planning, operation and management through a research project related on the art and craft. Students will play an important role in an international corporation and public organization.

Dept. of Mechanical Sciences and Engineering

Professors:

NOZAKI, Tomohiro, D. Eng.	Plasma Materials Science, Reaction Engineering, Thermal Engineering
YABE, Takashi, D. Eng.	Fluid Science and Engineering
INOUE, Takayoshi, D. Eng.	Thermal Engineering, Microscale Thermal Engineering
IWATSUKI, Nobuyuki, D. Eng.	Human Friendly Systems, Silent Engineering,
TAKAHARA, Hiroki, D. Eng.	Structural Dynamics
TAKEDA, Yukio, D. Eng.	Mechanical Systems Design
OHTAKE, Naoto, D. Eng.	Manufacturing Science and Technology
KISHIMOTO Kikuo, D. Eng.	Solids and Structures Engineering

TODOROKI, Akira, D. Eng.	Solids and Structures Engineering
CROSS Jeffrey Scott, D. Eng.	Engineering Science, Biosensor

Associate Professors:

OKAWA, Seiji, D. Eng.	Thermal Science and Engineering
OSHIMA, Shuzo, D. Eng.	Fluid Science and Engineering
MURAKAMI, Yoichi, D. Eng.	Energy and Thermal Engineering
OKADA, Masafumi, D. Eng.	Robotics, Control Engineering
AKASAKA, Hiroki, D. Eng.	Synthesis and Evaluation of Inorganic Carbon Materials
HIRATA, Atsushi, D. Eng.	Surface Engineering
INABA, Kazuaki, D. Eng.	Continuum Mechanics
MIZUTANI, Yoshihiro, D. Eng.	Structural Reliability Engineering, Non-destructive Testing
MOUGENOT, Céline, D. Eng.	Engineering Design
YOSHIDA, Takako, D. Ph.	Applied Brain Science

Dept. of Mechanical and Control Engineering

Professors:

SAITO, Yoshio, D. Eng.	Intelligent and Integrated Manufacturing
NAKAMURA, Haruo, D. Eng.	Fracture Mechanics, Strength of Materials
YOSHINO, Masahiko, D. Eng.	Nano/micro Manufacturing
INOUE, Hirotsugu, D. Eng.	Mechanics of Materials, Non-destructive Testing
OKAZAKI, Ken, D. Eng.	Energy Phenomena, Global Environment
SATOH, Isao, D. Eng.	Energy Applications
YAMAURA, Hiroshi, D. Eng.	Mechatronics, Dynamics, Control
INOU, Norio, D. Eng.	Biomechanics
HACHIYA, Hiroyuki, D.Eng.	Ultrasonic Measurements, Acoustic Imaging
OKUTOMI, Masatoshi, D. Eng.	Computer Vision, Image Processing
SAMPEI, Mitsuji, D. Eng.	Control Theory
FUJITA, Masayuki, D. Eng.	Systems and Control
KURABAYASHI, Daisuke, D. Eng.	Biorobotic Systems, Distributed Systems, Motion Planning
HIRAI, Shuichiro, D. Eng.	Global Environment Engineering
HANAMURA, Katsunori, D. Eng.	Environmental Thermal Engineering

Associate Professors:

YOSHIOKA, Hayato, D. Eng.	Ultraprecision Mechanical Systems
YAMAMOTO, Takatoki, D.Eng.	μ-TAS, Lab-on-chip, Nanobiotechnology, MEMS/NEMS
SAKAGUCHI, Motoki, D. Eng.	Mechanics and Strength of Materials
FUSHINOBU, Kazuyoshi, D. Eng.	Energy Phenomena
SAITO, Takushi, D. Eng.	Laser Processing, Material Processing
OHYAMA, Shinji, D. Eng.	Measurement Science
TANAKA, Masayuki, D.Eng.	Computational Photography, Image Processing
TSUKAGOSHI, Hideyuki, D. Eng.	Search and Rescue Robot, Fluid Powered Robot, Medical Actuator
YAMAKITA, Masaki, D. Eng.	Control Engineering, Robotics

Dept. of Mechanical and Aerospace Engineering

Professors:

TANAHASHI, Mamoru, D. Eng.	Fluid Dynamics, Heat and Mass Transfer, Combustion
KOSAKA, Hidenori, D. Eng.	Thermodynamics, Fluid Dynamics, Internal Combustion Engine

ODA Mitsushige, D. Eng.	Space Robotics, Space Systems
OKUMA, Masaaki, D. Eng.	Structural Dynamics, Acoustics, Optimum Design, CAE
SUZUMURA, Akio, D. Eng.	Joining Advanced Materials
KYOGOKU, Keiji, D. Eng.	Tribology
SUZUMORI, Koichi, D. Eng.	Robotics, Elastic Mechanism, New Actuator
MATUNAGA, Saburo, D.Eng.	Space Systems Engineering, Small Satellite

Associate Professors:

HORIUTI, Kiyosi, D. Eng.	Fluid Physics, Turbulence
YAMAZAKI, Takahisa, D. Eng.	Materials for Space Use, Advanced Joining, Surface Coating
SAITO, Shigeki, D. Eng.	Micromechanics, Micro Robotics
SHIMURA, Masayasu, D. Eng.	Fluid Dynamics, Thermodynamics, Combustion

2.5 Information and Communication Technology Course

Information and communications technology consists of a broad spectrum of technologies and is one of the most important social infrastructures supporting the industry, economy, and culture. This course is organized by the departments of electrical and electronic engineering, physical electronics, and communications and computer engineering, offering comprehensive research and education covering software and hardware technology in this field. The course covers topics in information and communications technology also including signal processing, electromagnetic waves, integrated circuits, and electron devices. We ensure that graduate students pursue challenging and valuable research on the course for professional education in the class and in the laboratories to become world-class leaders who can support this field.

All students in the course will belong to one of the departments mentioned above and are required to take classes prepared for the information and communications technology course.

Dept. of Electrical and Electronic Engineering

Professors:

AKAGI, Hirofumi, D. Eng.	Power Electronics, Electric Machinery
ANDO, Makoto, D. Eng.	Antennas, Millimeter Wave Communications, Sensing Systems, Electromagnetic Wave Theory
MIZUMOTO, Tetsuya, D. Eng.	Lightwave Circuits, Integrated Optics
YASUOKA, Koichi, D. Eng.	Plasma Engineering, Electric Power Engineering
CHIBA, Akira, D. Eng.	Drive Electronics, Power Mechatronics, Intelligent Drive
FURUYA, Yukitsuna, D. Eng.	Standardization, Mobile Communications
WATANABE, Tomoki, B. Eng.	Standardization, Electrical Railway Engineering

Associate Professors:

HIROKAWA, Jiro, D. Eng.	Antennas, Electromagnetic Wave Theory
FUJITA, Hideaki, D. Eng.	Power Electronics, Electric Machinery

Lecturers:

TAKEUCHI, Nozomi, D. Eng.	Applications of Plasma on Gas-Liquid Interface Electrohydrodynamics and its Applications

Dept. of Physical Electronics

Professors:

IWAMOTO, Mitsumasa, D. Eng.	Electronic Materials, Molecular Electronics, Organic Materials Electronics

KONAGAI, Makoto, D. Eng.	Semiconductors, Photovoltaics
MATSUZAWA, Akira, D. Eng.	Integrated Circuits, Mixed Signal LSI Design
ODA, Shunri, D. Eng.	Quantum Nano Devices, Semiconductor Devices
HATANO, Mutsuko, D. Eng.	Applied Physics, Electron Devices, Electronic Materials
NAKAGAWA, Shigeki, D.Eng.	Information Storage Devices, Spintronics, Magnetic Materials

Associate Professors:

MANAKA, Takaaki, D. Eng.	Organic Electronics, Nonlinear Optics
OKADA, Kenichi, D. Inf.	RF Circuit Design, Wireless Circuit Design
MIYAJIMA, Shinsuke, D. Eng.	Semiconductor Materials and Devices, Solar Cells, Thin-Film Solar Cells
KAWANO, Yukio, Ph. D.	Nano Electronics and Mechanics, Solid-State Physics and Engineering
KODERA, Tetsuo, D. Sc.	Electron Devices, Power Devices, Sensing Devices

Dept. of Communications and Computer Engineering

Professors:

FUKAWA, Kazuhiko, D. Eng.	Mobile Communications, Signal Processing, Adaptive Filter Theory
INOUE, Atsuki, D. Eng.	Low Power Circuit, Large Scale Integrated Circuit
KUNIEDA, Hiroaki, D. Eng.	VLSI Design Micro-architecture, VLSI Signal Processing
NISHIHARA, Akinori, D. Eng.	Digital Filters, Signal Processing, Educational Technology
OGATA, Wakaha, D. Eng.	Information Security, Cryptography
SUZUKI, Hiroshi, D. Eng.	Mobile Communications, Adaptive Signal Processing, Radio LAN Simulator with Multi-FPGA
TAKAGI, Shigetaka, D. Eng.	Integrated Circuits, Circuit Theory
UENO, Shuichi, D. Eng.	Theory of Parallel, VLSI and Quantum Computation
UYEMATSU, Tomohiko, D. Eng.	Information Theory, Coding Theory
YAMADA, Isao, D. Eng.	Signal Processing, Communication Theory, Optimization Theory

Associate Professors:

HARA, Yuko, D. Information Science	Hardware/Software Co-design, Reliable Embedded Systems
IIDA, Katsuyoshi, D. Computer Science	Network Systems Engineering, Performance and Systems Engineering Analysis
ISSHIKI, Tsuyoshi, Ph. D.	System-LSI Design Methodology, Reconfigurable Systems
KASAI, Kenta, Ph. D.	Coding Theory, LDPC Codes, Spatially Coupled Codes
MATSUMOTO, Ryutaroh, Ph. D.	Quantum Information Theory, Coding Theory
TAKAHASHI, Atsushi, D. Eng.	VLSI CAD, Physical Design, Synchronous Circuits
YAMAOKA, Katsunori, D. Eng.	Information and Communication Network

2.6 Advanced Materials and Chemicals Processing Course

The aim of this course is to cultivate scientists and engineers specializing in nanotechnology, advanced materials science and advanced chemical processing technology, disciplines which are at the core of sustainable development. The interactive and intensive curriculum, aimed at putting knowledge to work on an applicable level, is prepared by top-level departments, world-acclaimed in the field of ceramics science, organic and polymeric materials and chemical engineering. Through the course work, students are expected to become highly educated scientists and engineers possessing advanced specialized knowledge and state-of-the-art professional skills.

Dept. of Metallurgy and Ceramics Science (Ceramics Group)

Professors:

NAKAJIMA, Akira, Ph. D.	Environmental Ceramics, Surface Functional Materials

Associate Professors:

IKOMA, Toshiyuki, D. Eng.	Bioceramics, Biosensing, Nanomedicine, Tissue Engineering
TAKEDA, Hiroaki, D. Sc.	Electroceramics, Crystal Growth of Functional materials
MIYAUCHI, Masahiro, Ph. D.	Photo-electrochemistry, Photocatalysis, Chemical Synthesis of Nanoparticles
MATSUSHITA, Sachiko, D. Eng.	Top-Down and Bottom-Up Fabrication of Nanomaterials, Near-Field Optics

Dept. of Organic and Polymeric Materials

(Chemistry Group)

Professors:

TAKATA, Toshikazu, D.Sci.	Supramolecular Chemistry, Synthetic Polymer Chemistry
SERIZAWA, Takeshi, D. Eng.	Biomolecular Chemistry, Biomaterials Science and Engineering, Molecular Assembly
OTSUKA, Hideyuki, D. Eng.	Polymer Reactions, Smart Polymeric Materials, Polymer Synthesis
ISHIZONE, Takashi, D. Eng.	Polymer Synthesis, Living Polymerization

Associate Professor:

SAITO, Reiko, D. Eng.	Polymer Synthesis, Template Polymerization, Organic-inorganic Composites
KONISHI, Gen-ichi, D. Eng.	Polymer Synthesis, Photochemistry

(Materials Group)

Professors:

KAKIMOTO, Masa-aki, D. Sc.	Polymer Synthesis, Polymer Thin Films
KIKUTANI, Takeshi, D. Eng.	Fiber and Polymer Processing, Physical Properties of Polymers
TEZUKA, Yasuyuki, D. Sc.	Synthetic Polymer Chemistry
MORI, Takehiko, D. Sc.	Physical Chemistry of Organic Materials
OUGIZAWA, Toshiaki, D. Eng.	Physical Chemistry of Polymeric Materials, Polymer alloys
OUCHI Yukio, D. Eng.	Physical Chemistry
MORIKAWA, Junko, D. Eng.	Thermal Properties of Organic and Polymeric Materials
VACHA, Martin, D.Sc.	Optical Properties of Organic Materials

Associate Professors:

ISHIKAWA, Ken, D. Eng.	Optical and Electrical Properties of Organic Materials
SHIOYA, Masatoshi, D. Eng.	Polymer Composites, Mechanical Properties, Carbon Materials
HAYAKAWA, Teruaki, D.Eng.	Polymer Synthesis, Self-Organizing Polymeric Materials
ASAI, Shigeo, D. Eng.	Physical Properties of Organic Materials, Polymer Composites
HAYAMIZU, Yuhei, D. Sci.	Opto-Electronic Characterization, Bio-Nanomaterial Interface
MATSUMOTO, Hidetoshi, D. Eng.	Energy Conversion Materials, Nanomaterials
MICHINOBU, Tsuyoshi, D. Eng.	Polymer Synthesis, Semiconducting Polymers

Dept. of Chemical Engineering

Professors:

MASUKO, Masabumi, D. Eng.	Tribology, Applied Surface Chemistry, Physical Chemistry of Petroleum Products
OKOCHI, Mina, D.Eng.	Peptide Engineering, Biochemical Engineering, Bioelectronics
OHTAGUCHI, Kazuhisa, D. Eng.	Process Design, Biochemical Reaction Engineering
SEKIGUCHI, Hidetoshi, D. Eng.	Plasma Processing, Thermo-chemical Engineering
ITO, Akira, D.Eng.	Separation Processes, Membrane Separation
KUBOUCHI, Masatoshi, D. Eng.	Chemical Plant Materials, Composite Materials, Material Science
WIWUT, Tanthapanichakoon, Ph.D	Nanoparticle Engineering, Process Analysis and Simulation, Reaction Engineering

Associate Professors:

TANIGUCHI, Izumi, D. Eng.	Aerosol Science and Technology, Fine Powder Engineering
FUCHINO, Tetsuo, D. Eng.	Process Systems Engineering, Product Management
MATSUMOTO, Hideyuki, D. Eng.	Chemical Reactor Engineering, Process System Intelligent System
MORI, Shinsuke, D. Eng.	Plasma Processing, Heat Transfer
SHIMOYAMA, Yusuke, D. Eng.	Supercritical fluid, Phase equilibria, Mass transfer
AOKI, Saiko, D. Eng.	Tribology, Surface modification
YOSHIKAWA, Shiro, D. Eng.	Fluid Dynamics, Transport Phenomena
OOKAWARA, Shinichi, D. Eng.	Microfluidic Transport Phenomena, CFD (Computational Fluid Dynamics), Microreactor

Dept. of Applied Chemistry

Professors:

TANAKA,Ken, D. Eng.	Synthetic Organic Chemistry, Asymmetric Synthesis, Organometallic Chemistry
OHTOMO, Akira, D. Eng.	Inorganic Solid State Chemistry, Thin Film, Surface and Interface, Device Physics
MIKAMI, Koichi, D. Eng.	Synthetic Organic Chemistry, Organofluorine Chemistry, Organometallic Chemistry
WADA, Yuji, D. Eng.	Nano Materials Chemistry, Solar Energy Conversion, Chemical Processes Driven by Microwaves
*YAMANAKA, Ichiro, D. Eng.	Catalysis, Industrial Organic Chemistry, Industrial Physical Chemistry

*Dept. of Chemistry and Materials Science

Associate Professors:

TANAKA, Hiroshi, D. Eng.	Organic Chemistry, Chemical Biology, Carbohydrate Chemistry
OKAMOTO, Masaki, D. Eng.	Catalyst Chemistry
KUWATA, Shigeki, D. Eng.	Coordination Chemistry, Organometallic Chemistry
ITO, Shigekazu, D. Sci.	Electro-Functional Organic Materials, Organic Synthesis
TAKAO, Toshiro, D. Eng.	Organometallic Chemistry, Inorganic Chemistry
SUZUKI, Eiichi, D. Eng.	Industrial Organic Chemistry, Industrial Physical Chemistry, Catalyst and Chemical

3. Guide to Study in Sustainable Engineering Program

Sustainable Engineering Program (SEP) students are aiming Master degree and Doctoral degree in the scheme of Integrated Doctoral Education Program.

To acquire the degrees, students in SEP must satisfy several requirements as follows.

【Master's degree】

For a Master's degree a student must meet the requirements as follows:

(1) Credits
   a. 2 credits or more must be acquired from the common subjects.
   b. 16 credits or more must be acquired from the subjects provided by special course which she/he enrolls in.
   c. The seminar must be acquired in each term.

(2) Thesis
   The student must complete a special research, submit a thesis for the degree and take the final examination given after the submission of her/his thesis for the qualification.

The students qualified by the examination committee can go onto the Doctoral program with some formalities.

【Doctoral degree】

For a Doctoral degree a doctoral candidate must satisfy the following requirements:

(1) Seminar in each term and Off-Campus Project must be acquired.
(2) Beside the requirement (1), 22 credits or more must be acquired from the subjects provided in the Master's and Doctoral programs.
(3) The candidate must complete and upload a thesis for the degree, and take the final examination and evaluation of his/her thesis.

The candidate who satisfies the above requirements and passes the final examination is awarded a Doctoral degree.

The minimum period of study is three years in total, which include both the Master's and Doctoral program for the both degrees. Note that the above requirements for Master and Doctoral degrees are minimal and additional requirements are conditioned depending on the special course and department which the student enrolls. See P.287 for the details. All students should consult with their own supervisors or program/special course coordinators about the study plan.

4. Tables of Course Subjects

All lectures offered in this program are given in English. The students can learn the following subjects: 1) specialized subjects in the enrolled special course, 2) subjects in the other special courses relevant to the specialty, and 3) common subjects in SEP. Beside the above subjects, the students are required to take part in Off-Campus Project, i.e., internship program primarily in domestic companies/institutions. The course subjects provided by SEP are given in the following tables. Please note that the subjects might be subject to change.

4.0 Common subjects in SEP

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Sustainable Development and Integrated Management Approach	IDE	70019	1	1	0	S	a	B/I
Principles of International Co-existence	IDE	70005	2	0	0	S	o	B/I
Technical Management for Sustainable Engineering	G School of Eng.	99319	2	0	0	A	a	B/I
Sustainable Engineering Technology	G School of Eng.	99302	1	1	0	A	a	B/I Required
Degradation of Infrastructure	MCS	24047	1	0	0	A	o	B/I
Science of Materials	MCS	24051	1	0	0	A	e	B/I
Chemical Engineering for Advanced Materials and Chemicals Processing I	Ch Eng	35034	2	0	0	A	a	B/I
Energy Systems and Environment	NE	71049	2	0	0	S	e	B/I
Nanomaterials Science	NE	71066	2	0	0	A	o	B
Communication Skill in Japanese Industry I	G School of Eng.	99349	0	1	0	A	a	B
Communication Skill in Japanese Industry II	G School of Eng.	99350	0	1	0	S	a	B
International Research Program 1A,1B	G School of Eng.	99341 99342	0	0	1	S,A	A	I
International Research Program 2A,2B	G School of Eng.	99343 99344	0	0	2	S,A	A	I
International Research Program 3A,3B	G School of Eng.	99345 99346	0	0	4	S,A	A	I

** B: Basic, A: Applied, I: Interdisciplinary

* IDE : Dept. International Development Engineering
MCS: Dept. Metallurgy and Ceramics Sciences
Ch Eng: Dept. Chemical Engineering
NE: Dept. Nuclear Engineering

4.1 Development and Environmental Engineering Course

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Principles of International Development Project	IDE	70001	0	2	0	S	a	B
Mathematical and Statistics for International Development Engineering	IDE	70042	2	0	0	A	a	B
International Development Projects - Case Method	IDE	70037	0	2	0	A	a	B/I
Environmental Engineering in International Development	IDE	70002	2	0	0	A	o	B/I
Advanced Technical Communication Skills I	CE	61062	1	1	0	S	a	B/I
Advanced Technical Communication Skills II	CE	61063	1	1	0	A	a	B/I
International Collaboration I	CE	61071	0	1	0	S	a	B/I
International Collaboration II	CE	61072	0	1	0	A	a	B/I
Advanced Course on Coastal Environments	MEI	77048	2	0	0	S	e	A
Regional Atmospheric Environment	IDE	70009	1	0	0	A	a	A
Aquatic Environmental Science	CE	61073	2	0	0	S	e	A
Environmental Statistics	CE	61074	2	0	0	S	o	B
Water Quality Dynamics	CE	61082	2	0	0	A	e	A
GIS in Water Resources Engineering	CE	61080	1	1	0	A	a	A
Advanced Hydrology and Water Resources Management	CE	61079	2	0	0	A	a	A
Water Resource Systems	CE	61085	2	0	0	S	a	A
Open channel Hydraulics	EST	98053	1	0	0	S	a	B
Environmental Hydraulics	EST	98067	1	0	0	S	a	B
Watershed Hydrology	EST	98060	1	0	0	S	a	B
Geo-Environmental Engineering	CE	61049	2	0	0	S	a	B
Physical Modelling in Geotechnics	CE	61061	2	0	0	A	a	A
Advanced Mathematical Methods for Infrastructure and Transportation Planning	CE	61014	2	0	0	S	o	B
Transportation Network Analysis	CE	61081	2	0	0	A	e	B
Transportation Economics	CE	61066	1	0	0	A	e	A
Theory of Regional Planning Process	BE	92047	2	0	0	S	e	A
Environmental Transportation Engineering	BE	92048	1	0	0	A	o	B
City/Transport Planning and the Environment	BE	92035	1	0	0	A	a	A
Stability Problems in Geotechnical Engineering	CE	61034	2	0	0	A	a	A
Mechanics of Geomaterials	CE	61038	2	0	0	S	a	B
Advanced Concrete Technology	IDE	70043	2	0	0	A	a	B
Mechanics of Structural Concrete	CE	61003	2	0	0	S	o	B
Utilization of Resources and Wastes for Environment	IDE	70041	2	0	0	A	a	A
Maintenance of Infrastructure	CE	61083	2	0	0	S	e	A
Fracture Control Design of Steel Structures	CE	61005	2	0	0	A	e	A
Analysis of Vibration and Elastic Wave	MEI	77019	2	0	0	S	o	B
Introduction to Solid Mechanics	CE	61065	2	0	0	S	a	B/I
Advanced Course on Elasticity Theory	CE	61048	2	0	0	A	a	B/I
Principles of Construction Management	CE	61046	2	0	0	A	o	B/I

Probabilistic Concepts in Engineering Design	CE	61047	2	0	0	A	o	B/I
Civil Engineering Analysis	CE	61013	2	0	0	A	a	B
Rural Telecommunications	IDE	70020	2	0	0	A	a	A
Chemical Process for Development	IDE	70014	1	0	0	A	a	A
Welding and Joining Technology	IDE	70031	2	0	0	S	a	A
Perspective Understanding of Various Kinds of Material	IDE	70032	2	0	0	A	a	A
Introduction to Economics for Engineers	IDE	70029	2	0	0	S	a	B/I
Project Evaluation for Sustainable Infrastructure	IDE	70030	2	0	0	S	a	A/I
Coastal Disaster Mitigation	IDE	70044	2	0	0	S	a	A
Advanced Topics in Civil Engineering I	CE	61084	2	0	0	S	a	A
Advanced Topics in Civil Engineering II	CE	61055	2	0	0	A	a	A
Field Work in Engineering for Sustainable Development A	IDE	70006	0	0	1	S	a	A
Field Work in Engineering for Sustainable Development B	IDE	70018	0	0	1	A	a	A
International Internship I	CE	61077	0	1	0	S	a	A
International Internship II	CE	61078	0	1	0	A	a	A
Development and Environmental Engineering Off-Campus Project I (CE), (IDE)	CE	61551	0	0	4	A	a	I or II required Required
	IDE	70039						
Development and Environmental Engineering Off-Campus Project II (CE), (IDE)	CE	61552	0	0	4	S	a	
	IDE	70040						
Seminar of Development and Environmental Engineering I, III (CE), (IDE)	CE	61705 61707	0	2	0	A	a	Required
	IDE	70705 70707	0	2	0	A	a	Required
Seminar of Development and Environmental Engineering II, IV(CE), (IDE)	CE	61706 61708	0	2	0	S	a	Required
	IDE	70706 70708	0	2	0	S	a	Required
Seminar of Development and Environmental Engineering V, VII, IX (CE), (IDE)	CE	61851 61853 61855	0	2	0	A	a	Required
	IDE	70851 70853 70855						
Seminar of Development and Environmental Engineering VI, VIII, X (CE), (IDE)	CE	61852 61854 61856	0	2	0	S	a	Required
	IDE	70852 70854 70856						

IDE: Dept. International Development Engineering

CE: Dept. Civil Engineering

MEI: Dept. Mechanics and Environmental Informatics

BE: Dept. Built Environment

4.2 Nuclear Engineering Course

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A:Autumn	Opening year a: Annually e: Even o: Odd	Category* Remarks
Basic Nuclear Physics	NE	71062	2	0	0	A	o	B
Nuclear Reactor Physics	NE	71090	2	1	0	A	a	B
Nuclear Chemistry and Radiation Science	NE	71043	2	0	0	A	o	B
Nuclear Energy Systems	NE	71045	2	0	0	A	e	B
Nuclear Reactor Safety	NE	71046	2	0	0	S	o	B
Nuclear Reactor Design and Engineering	NE	71002	2	0	0	A	e	A
Energy Systems and Environment	NE	71049	2	0	0	S	a	B
Nuclear Materials Science	NE	71052	2	0	0	A	e	A
Reactor Chemistry and Chemical Engineering	NE	71083	2	0	0	S	e	A
Reactor Thermal Hydrodynamics	NE	71044	2	0	0	A	o	A
Accelerators in Applied Research and Technology	NE	71063	2	0	0	S	o	A
Plasma Science	NE	71064	2	0	0	A	o	I
Biological Effects and Medical Application of Radiation	NE	71128	2	0	0	A	e	I
Radiation Physics	NE	71137	2	0	0	A	e	B
Experiments for Reactor Physics	NE	71700	0	0	2	S	a	B
Introductory Experiments in Nuclear Engineering	NE	71092	1	0	1	S	a	B
Specific Interdisciplinary Subject in Nuclear Engineering A	NE	71129	0	2	0	S	a	B☆
Specific Interdisciplinary Subject in Nuclear Engineering B	NE	71130	0	2	0	A	a	B☆
Nuclear Engineering Research Skills I	NE	71138	0	2	0	S	a	B
Nuclear Engineering Research Skills II	NE	71139	0	2	0	A	a	B
Nuclear Engineering Off-Campus Project I	NE	71511	0	4	0	S	a	I or II required
Nuclear Engineering Off-Campus Project II	NE	71512	0	4	0	A	a	
Seminar in Nuclear Engineering I, III	NE	71701 70703	0	1	0	S	a	Required in Master's Course
Seminar in Nuclear Engineering II, IV	NE	71702- 70704	0	1	0	A	a	Required in Master's Course
Seminar in Nuclear Engineering V, VII, IX	NE	71801- 71803 71805	0	2	0	S	a	Required in Doctoral Course
Seminar in Nuclear Engineering VI, VIII, X	NE	71802 71804 71806	0	2	0	A	a	Required in Doctoral Course

* B: Basic, A: Applied, I: Interdisciplinary; NE: Dept. Nuclear Engineering

4.3 Infrastructure Metallic Materials Course

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Applied Diffraction Crystallography in Metals and Alloys	MCS	24002	2	0	0	S	o	B
Crystallography for Microstructural Characterization	MCS	97017	2	0	0	A	o	B
Advanced Metal Physics	MCS	24043	2	0	0	A	a	B
Lattice Defects & Mechanical Properties of Materials	MSE	96049	2	0	0	A	e	B
Thermodynamics for Metallurgists	MCS	24042	2	0	0	S	e	B
Physical Chemistry of Melts	MCS	24006	2	0	0	A	o	B
Transport Phenomena of Metals and Alloys	MCS	24055	2	0	0	A	e	B
Phase Transformations in Solids	MCS	24008	2	0	0	A	e	A
Microstructures of Metals and Alloys	MSE	24010	2	0	0	A	o	A
Characteristics and Applications of Intermetallic Alloys	MSE	96048	2	0	0	S	e	A
Phase Diagram and Related Thermodynamics	IMS	97036	2	0	0	S	e	A
Science and Engineering of Solidification	MCS	96047	2	0	0	S	e	A
Advanced Course in Design and Fabrication of Micro/Nano Materials	MSE	96055	2	0	0	A	o	A
Diffusion in Alloys	MSE	96050	2	0	0	A	e	B
Environmental Degradation of Materials	CMS	19066	2	0	0	A	o	I
Advanced Metallurgical Engineering Laboratory	MCS	24045	0	0	4	A	a	B
Materials Off-Campus Project I, II	MCS	24521, 24522	0	0	4		a	I or II required
Seminar in Materials Science and Technology I-IV	MCS	24701 -24704	0	1	0		a	Required
Seminar in Materials Science and Technology V-X	MCS	24801 -24806	0	2	0		a	Required
Material Research Methodology I-IV	MCS	24705 -24708	0	1	0		a	A

** B: Basic, A: Applied, I: Interdisciplinary

* MCS: Dept. Metallurgy and Ceramics Sciences
MSE: Dept. Materials Science and Engineering
IMS: Dept. Innovative Material Science
CMS: Dept. Chemistry and Materials Science

4.4 Mechanical Production Engineering Course

Course Title	Department offering course	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Advanced Course of Fluid Power Robotics	Mechanical Eng.	40100	1	0	0	A	a	A
Thermal Radiation Transfer Engineering in Environment	Mechanical Eng.	40182	2	0	0	S	a	A
Advanced Course of Mechanical Vibration	Mechanical Eng.	40067	2	0	0	A	a	B
Advanced Course on Energy Physics	Mechanical Eng.	40032	2	0	0	S	a	B
Intensive Thermal Engineering	Mechanical Eng.	40082	2	0	0	A	a	B
Thermal Engineering in Environmental Problems	Mechanical Eng.	40042	1	0	0	A	a	A
Advanced Course on Basic Phenomenon of Liquid/Solid Phase Change	Mechanical Eng.	40147	1	0	0	S	a	B
Physical Chemistry of Solution and Mixture	Mechanical Eng.	40181	1	0	0	A	a	A
Advanced Course of Measurement Systems	Mechanical Eng.	40044	1	0	0	A	a	A
Advanced Course of Mechanics of Materials	Mechanical Eng.	40086	1	0	0	A	a	B
Advanced course of Mechanics of Fatigue and Fracture of Materials	Mechanical Eng.	40150	1	0	0	S	a	A
Linear Fracture Mechanics	Mechanical Eng.	40146	1	0	0	A	a	B
Special Lecture on Strength of Materials A	Mechanical Eng.	40019	1	0	0	S	e	A
Special Lecture on Strength of Materials B	Mechanical Eng.	40020	1	0	0	A	e	A
Special Lecture on Strength of Materials C	Mechanical Eng.	40021	1	0	0	A	o	A
Special Lecture on Strength of Materials D	Mechanical Eng.	40022	1	0	0	A	o	A
Creative Design for Innovation	Mechanical Eng.	40174	1	1	0	A	a	A
Intelligent Control	Mechanical Eng.	40031	1	0	0	S	a	I
Human Brain Functions and Their Measurements	Mechanical Eng.	40180	2	0	0	S	a	A
Manufacturing Engineering and Technology I	Mechanical Eng.	40162	1	0	0	S	o	B
Manufacturing Engineering and Technology II	Mechanical Eng.	40170	1	0	0	S	e	B
Special Lecture on Mechano-Infra Engineering A	Mechanical Eng.	40015	1	0	0	S	a	I
Special Lecture on Mechano-Infra Engineering B	Mechanical Eng.	40016	1	0	0	S	a	I
Special Lecture on Mechano-Infra Engineering C	Mechanical Eng.	40017	1	0	0	A	a	I
Special Lecture on Mechano-Infra Engineering D	Mechanical Eng.	40018	1	0	0	A	a	I
Automotive Structural System Engineering (TAIST)	Mechanical Eng.	40138	3	0	0	A	a	A
Automotive Comfort Mechanics Engineering (TAIST)	Mechanical Eng.	40139	3	0	0	A	a	A
Advanced Production Engineering (TAIST)	Mechanical Eng.	40140	3	0	0	A	a	A
Combustion Engineering (TAIST) [This class will not be opened in 2014.]	Mechanical Eng.	40141	3	0	0	A	a	A
Advanced Internal Combustion Engine Engineering and Future Power Train (TAIST)	Mechanical Eng.	40142	3	0	0	A	a	A
Basics of Automotive Design (TAIST)	Mechanical Eng.	40143	3	0	0	A	a	A
Practice of Automotive Design (TAIST)	Mechanical Eng.	40144	3	0	0	A	a	A
System Project Research A		40165	0	2	0	A	a	I
System Project Research B		40166	0	2	0	S	a	I

Seminar in Mechanical and Production Engineering A-D (For IGP-A Master Course)		40701-40704	0	2	0	A	a	Required
Mechanical and Production Engineering Off-Campus Project I		40167	0	4	0	A	a	I or II required
Mechanical and Production Engineering Off-Campus Project II		40168	0	4	0	S	a	
Seminar in Mechanical Sciences and Engineering I – IV (For IGP-C Master Course students)	Mechanical Sciences and Engineering	46721-46724	0	2	0	S/A	a	Required
Seminar in Mechanical Sciences and Engineering V – X (For IGP-A and IGP-C Doctoral Course students)	Mechanical Sciences and Engineering	46801-46806	0	2	0	S/A	a	Required
Seminar in Mechanical and Control Engineering I – IV (For IGP-C Master Course students)	Mechanical and Control Engineering	47721-47724	0	2	0	S/A	a	Required
Seminar in Mechanical and Control Engineering V – X (For IGP-A and IGP-C Doctoral Course students)	Mechanical and Control Engineering	47801-47806	0	2	0	S/A	a	Required
Seminar in Mechanical and Aerospace Engineering I – IV (For IGP-C Master Course students)	Mechanical and Aerospace Engineering	48721-48724	0	2	0	S/A	a	Required
Seminar in Mechanical and Aerospace Engineering V – X (For IGP-A and IGP-C Doctoral Course students)	Mechanical and Aerospace Engineering	48801-48806	0	2	0	S/A	a	Required

* * B: Basic, A: Applied, I: Interdisciplinary

4.5 Information Communication Technology Course

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Advanced Electromagnetic Waves (IGP-A ICT)	EEE	54027	2	0	0	S	a	B
Wireless Communication Engineering (IGP-A ICT)	EEE	54026	2	0	0	S	a	B
MIMO Communication Systems (IGP-A ICT)	EEE	54024	2	0	0	A	a	B
Guided Wave Circuit Theory(IGP-A ICT)	EEE	54025	2	0	0	S	a	B
Plasma Engineering (IGP-A ICT)	EEE	54029	2	0	0	S	a	B
Advanced Course of Power Electronics (IGP-A ICT)	EEE	54030	2	0	0	S	a	B
Electric Power and Motor Drive System Analysis (IGP-A ICT)	EEE	54022	2	0	0	A	a	A
Magnetic Levitation and Magnetic Suspension (IGP-A ICT)	EEE	54031	2	0	0	S	a	B
Technology Innovation and Standardization I (IGP-A ICT)	EEE	54028	2	0	0	S	a	B
Technology Innovation and Standardization II (IGP-A ICT)	EEE	54023	2	0	0	A	a	B
Introduction to Photovoltaics (IGP-A ICT)	PE	55022	2	0	0	A	a	A
Advanced Electron Devices (IGP-A ICT)	PE	55023	2	0	0	A	a	B
Mixed Signal Systems and Integrated Circuits (IGP-A ICT)	PE	55024	2	0	0	A	a	B
Electronic Materials A (IGP-A ICT)	PE	55026	2	0	0	S	a	B
Electronic Materials B (IGP-A ICT)	PE	55025	2	0	0	A	a	B
Electronic Materials D (IGP-A ICT)	PE	55027	2	0	0	S	a	B
Thin Film Devices and Their Applications (IGP-A ICT)	PE	55028	2	0	0	S	a	B
Materials and Processes for Microsystems (IGP-A ICT)	PE	55032	1	0	0	S	a	
Topics on Communication Systems Engineering (IGP-A ICT)	CCE	56030	2	0	0	S	a	A
VLSI Design Methodologies (IGP-A ICT)	CCE	56031	2	0	0	S	a	B
Advanced Signal Processing (IGP-A ICT)	CCE	56032	2	0	0	S	a	B
Quantum Information Processing (IGP-A ICT)	CCE	56033	2	0	0	S	a	I
VLSI System Design (IGP-A ICT)	CCE	56029	2	0	0	A	a	B
Wireless Signal Processing (IGP-A ICT)	CCE	56035	2	0	0	A	a	A
Advanced Coding Theory (IGP-A ICT)	CS	76056	2	0	0	S	a	B
Speech Information Processing (IGP-A ICT)	CS	76057	2	0	0	S	o	A
Rural Telecommunications (IGP-A ICT)	IDE	70047	2	0	0	A	a	I
Electrical and Electronic Engineering Off-Campus Project I or II	EEE	54501 54502	0	4	0	S/A	a	I or II required
Physical Electronics Off-Campus Project I or II	PE	55501 55502	0	4	0	S/A	a	
Communication and Computer Engineering Off-Campus Project I or II	CCE	56521 56522	0	4	0	S/A	a	I or II required
Seminar I - X on Electrical and Electronic Engineering	EEE	54705-08 54801-06	0	2	0	S/A	a	
Seminar I - X on Physical Electronics	PE	55705-08 55801-06	0	2	0	S/A	a	I or II required

Seminar I - X on Communications and Computer Engineering	CCE	56721-24 56811-16	0	2	0	S/A	a	

** B: Basic, A: Applied, I: Interdisciplinary

EEE: Dept. of Electrical and Electronic Engineering
PE :Dept. of Physical Electronics
CCE: Dept. of Communications and Computer Engineering
CS: Dept. Computer Science
IDE: Dept. International Development Engineering

4.6 Advanced Materials and Chemicals Processing Course

Course Title	Department offering course*	Course Number	Credit			Semester S: Spring A*Autumn	Opening year a: Annually e: Even o: Odd	Category ** Remarks
Advanced Separation Operations	Chemical Engineering	35005	2	0	0	A	a	B
Transport Phenomena and Operation for Advanced Materials and Chemicals Processing	Chemical Engineering	35031	2	0	0	S	a	B
Fine Particle Engineering	Chemical Engineering	35032	2	0	0	S	a	B
Material Science and Chemical Equipment Design	Chemical Engineering	35033	2	0	0	A	a	B
Chemical Engineering for Advanced Materials and Chemicals Processing I	Chemical Engineering	35034	2	0	0	A	a	B
Chemical Engineering for Advanced Materials and Chemicals Processing II	Chemical Engineering	35035	2	0	0	S	a	B
Advanced Course in Functional Soft Materials	Org. & Polym. Mater.	25008	2	0	0	S	e	B
Advanced Course in Surface Properties of Organic Materials	Org. & Polym. Mater.	25022	2	0	0	S	a	B
Advanced Course in Organic Materials for Photonics and Biosensing	Org. & Polym. Mater.	25023	2	0	0	A	A	B
Advanced Course in Organic and Soft Materials Chemistry	Org. & Polym. Mater.	25042	2	0	0	S	O	B
Advanced Course in Wettability Control of Solid Surface	Mater. Sci. Eng.	24050	2	0	0	S	O	B
Advanced Course of Nano-Bionics	Mater. Sci. Eng.	24053	2	0	0	S	e	B
Advanced Chemical Reaction Engineering	Chemical Engineering	35002	2	0	0	S	a	A
Catalytic Process and Engineering	Chemical Engineering	35008	2	0	0	S	a	A
Plasma Chemistry and Plasma Processing	Chemical Engineering	35036	2	0	0	A	a	A
Advanced Course in Physical Properties of Organic Materials	Org. & Polym. Mater.	25021	2	0	0	A	a	A
Advanced Course of Organic Materials Design	Chem. & Mater. Sci.	19007	2	0	0	S	o	A
Advanced Course of Polymer Chemistry	Org. & Polym. Mater.	25029	2	0	0	A	o	A
Life Cycle Engineering	Chemical Engineering	35037	2	0	0	A	a	I
Chemical Engineering in Global Business	Chemical Engineering	35030	2	0	0	A	a	I
Chemical Engineering Off-Campus Project I	Chemical Engineering	35501	0	0	4	S	a	I or II required
Chemical Engineering Off-Campus Project II	Chemical Engineering	35502	0	0	4	A	a	
Materials Off-Campus Project I	Mater. Sci. Eng.	24521	0	0	4	S	a	I or II required
Materials Off-Campus Project II	Mater. Sci. Eng.	24522	0	0	4	A	a	
Organic and Polymeric Materials Off-Campus Project I	Org. & Polym. Mater.	25511	0	4	0	S	a	I or II required
Organic and Polymeric Materials Off-Campus Project II	Org. & Polym. Mater.	25512	0	4	0	A	a	
Specific Interdisciplinary Subject in Chemical Engineering A	Chemical Engineering	35045	0	2	0	S	a	I☆
Specific Interdisciplinary Subject in Chemical Engineering B	Chemical Engineering	35046	0	2	0	A	a	I☆
Specific Interdisciplinary Subjects in Organic and Polymeric Materials A	Org. & Polym. Mater.	25044	0	2	0	S	a	☆
Specific Interdisciplinary Subjects in Organic and Polymeric Materials B	Org. & Polym. Mater.	25045	0	2	0	A	a	☆

Seminar in Chemical Engineering I	Chemical Engineering	35701	0	1	0	S	a	Required Master Course ①
Seminar in Chemical Engineering II	Chemical Engineering	35702	0	1	0	A	a	Required Master Course ①
Seminar in Chemical Engineering III	Chemical Engineering	35703	0	1	0	S	a	Required Master Course ②
Seminar in Chemical Engineering IV	Chemical Engineering	35704	0	1	0	A	a	Required Master Course ②
Seminar in Chemical Engineering V	Chemical Engineering	35801	0	2	0	S	a	Required Doctoral Course ①
Seminar in Chemical Engineering VI	Chemical Engineering	35802	0	2	0	A	a	Required Doctoral Course ①
Seminar in Chemical Engineering VII	Chemical Engineering	35803	0	2	0	S	a	Required Doctoral Course ②
Seminar in Chemical Engineering VIII	Chemical Engineering	35804	0	2	0	A	a	Required Doctoral Course ②
Seminar in Chemical Engineering IX	Chemical Engineering	35805	0	2	0	S	a	Required Doctoral Course ③
Seminar in Chemical Engineering X	Chemical Engineering	35806	0	2	0	A	a	Required Doctoral Course ③
Seminar in Materials Science and Technology I	Mater. Sci. Eng.	24701	0	1	0	S	a	Required Master Course ①
Seminar in Materials Science and Technology II	Mater. Sci. Eng.	24702	0	1	0	A	a	Required Master Course ①
Seminar in Materials Science and Technology III	Mater. Sci. Eng.	24703	0	1	0	S	a	Required Master Course ②
Seminar in Materials Science and Technology IV	Mater. Sci. Eng.	24704	0	1	0	A	a	Required Master Course ②
Materials Research Methodology I	Mater. Sci. Eng.	24705	0	1	0	S	a	A
Materials Research Methodology II	Mater. Sci. Eng.	24706	0	1	0	A	a	A
Materials Research Methodology III	Mater. Sci. Eng.	24707	0	1	0	S	a	A
Materials Research Methodology IV	Mater. Sci. Eng.	24708	0	1	0	A	a	A
Seminar in Materials Science and Technology V	Mater. Sci. Eng.	24801	0	2	0	S	a	Required Doctoral Course ①
Seminar in Materials Science and Technology VI	Mater. Sci. Eng.	24802	0	2	0	A	a	Required Doctoral Course ①
Seminar in Materials Science and Technology VII	Mater. Sci. Eng.	24803	0	2	0	S	a	Required Doctoral Course ②

Seminar in Materials Science and Technology VIII	Mater. Sci. Eng.	24804	0	2	0	A	a	Required Doctoral Course ②
Seminar in Materials Science and Technology IX	Mater. Sci. Eng.	24805	0	2	0	S	a	Required Doctoral Course ③
Seminar in Materials Science and Technology X	Mater. Sci. Eng.	24806	0	2	0	A	a	Required Doctoral Course ③
Seminar in Organic and Polymeric Materials I	Org. & Polym. Mater.	25731	0	1	0	S	a	Required Master Course ①
Seminar in Organic and Polymeric Materials II	Org. & Polym. Mater.	25732	0	1	0	A	a	Required Master Course ①
Seminar in Organic and Polymeric Materials III	Org. & Polym. Mater.	25733	0	1	0	S	a	Required Master Course ②
Seminar in Organic and Polymeric Materials IV	Org. & Polym. Mater.	25734	0	1	0	A	a	Required Master Course ②
Research Skills on Organic and Polymeric Materials 1	Org. & Polym. Mater.	25735	0	1	0	S	a	Required Master Course ①
Research Skills on Organic and Polymeric Materials 1I	Org. & Polym. Mater.	25736	0	1	0	A	a	Required Master Course ①
Research Skills on Organic and Polymeric Materials 1II	Org. & Polym. Mater.	25737	0	1	0	S	a	Required Master Course ②
Research Skills on Organic and Polymeric Materials 1V	Org. & Polym. Mater.	25738	0	1	0	A	a	Required Master Course ②
Seminar in Organic and Polymeric Materials V	Org. & Polym. Mater.	25831	0	2	0	S	a	Required Doctoral Course ①
Seminar in Organic and Polymeric Materials VI	Org. & Polym. Mater.	25832	0	2	0	A	a	Required Doctoral Course ①
Seminar in Organic and Polymeric Materials VII	Org. & Polym. Mater.	25833	0	2	0	S	a	Required Doctoral Course ②
Seminar in Organic and Polymeric Materials VIII	Org. & Polym. Mater.	25834	0	2	0	A	a	Required Doctoral Course ②
Seminar in Organic and Polymeric Materials IX	Org. & Polym. Mater.	25835	0	2	0	S	a	Required Doctoral Course ③
Seminar in Organic and Polymeric Materials X	Org. & Polym. Mater.	25836	0	2	0	A	a	Required Doctoral Course ③
Advanced Molecular Designing	Applied Chemistry	34003	2	0	0	A	a	A
Organometallic Catalysis	Applied Chemistry	34021	2	0	0	A	a	B
Advanced Solid State Chemistry for Energy and Environment Issues	Applied Chemistry	34022	2	0	0	A	a	I

Seminar in Applied Chemistry I	Applied Chemistry	34701	0	1	0	S	a	Required Master Course ①
Seminar in Applied Chemistry II	Applied Chemistry	34702	0	1	0	A	a	Required Master Course ①
Seminar in Applied Chemistry III	Applied Chemistry	34703	0	1	0	S	a	Required Master Course ②
Seminar in Applied Chemistry IV	Applied Chemistry	34704	0	1	0	A	a	Required Master Course ②
Seminar in Applied Chemistry V	Applied Chemistry	34801	0	2	0	S	a	Required Doctoral Course ①
Seminar in Applied Chemistry VI	Applied Chemistry	34802	0	2	0	A	a	Required Doctoral Course ①
Seminar in Applied Chemistry VII	Applied Chemistry	34803	0	2	0	S	a	Required Doctoral Course ②
Seminar in Applied Chemistry VIII	Applied Chemistry	34804	0	2	0	A	a	Required Doctoral Course ②
Seminar in Applied Chemistry IX	Applied Chemistry	34805	0	2	0	S	a	Required Doctoral Course ③
Seminar in Applied Chemistry X	Applied Chemistry	34806	0	2	0	A	a	Required Doctoral Course ③

** B: Basic, A:Applied,I:Interdisciplinary

Chemical Engineering, ChE: Dept. Chemical Engineering
Org. & Polym. Mater.: Dept. Organic and Polymeric Materials
Mater. Sci. Eng.: Dept. Metallurgy and Ceramics Science
Chem. & Mater. Sci.: Dept. Chemistry and Materials Science
Nuclear Engineering: Dept. Nuclear Engineering
Applied Chemistry: Dept. Applied Chemistry

☆: Only the ACEEES students can take this course. In order to promote interdisciplinary research on campus, students are required to take/register courses provided by designated other majors/programs rather than their own majors/programs.

5. Syllabus of Course Subjects

5.0 Common subjects in SEP

70019

Sustainable Development and Integrated Management Approach

Spring Semester (1-1-0) (Every Year)

Prof. Jun-ichi TAKADA, and Prof. Shinobu YAMAGUCHI

[Aims]

This course aims at introducing various approaches to sustainable development. The first half of the course looks at major theories of international development and how they are applied in practical situations. The latter part will take a close look at on-going development projects in selected countries with implication of role of engineering (and engineers). The students are expected to participate in discussion and analyze the project from engineering point of view within the context of "Sustainable Development" Then the course will be followed by the field trip to the development project site, possibly for conducting feasibility studies. The students are responsible to prepare, to contribute, and to express own opinions and ideas. This means, the students' participation in classroom makes a difference.

[Outline]

1. Introduction to the course
2. Lecture/Discussion: Development vs. Sustainable Development
3. Lecture/Discussion: Development models
4. Group Presentation: Sustainable Development (1)
5. Group Presentation: Sustainable Development (2)
6. Lecture/Discussion: Feasibility Study as a Tool of Sustainable development
7. Lecture/Discussion: Stakeholders Analysis (1)
8. Lecture/Discussion: Stakeholders Analysis (2)
9. Introduction to Development Project (1): "Sustainable use of ICT for improving the quality of primary education in rural Mongolia"
10. Introduction to Development Project (2): "Application of ICT to promote sustainable development of heritage site of Luang Prabang, Lao PDR"
11. In-Class Group Exercises
12. Group Presentation: Stakeholder Analysis
13. In-Class Group Exercises
14. Group Presentation: Mongolia Team
15. Group Presentation: Lao Team

70005

Principles of International Co-existence

Spring Semester (2-0-0) (Odd Years)

Prof. Hirofumi HINODE

[Aims]

Engineers sometimes encounter difficult ethical problems In order to co-exist with others, we should know about ourselves as well as others. In this lecture, we look into the relationship between others and us in the different levels of individual, races, corporations and nations.

[Outline]

1. Introduction
2. Relationship between Korea and Japan

3. Relationship between China and Japan
4. Humanitarian mind
5. Religion in the U.S.
6. Religion in the Mideast
7. International enterprise
8. Examples of establishing corporation in foreign countries (1)
9. Examples of establishing corporation in foreign countries (2)
10. Examples of establishing corporation in foreign countries (3)
11. Collaboration at the international field
12. Discussion
13. Summary

99319

Technical Management for Sustainable Engineering

Autumn Semester (2-0-0) (Every Year)

Coordinators of SEP and invited lectures

[Aims and Scopes]

To educate high skill experts in technology with proper understanding of management in the industries where their specialties and technology are utilized, this course provides basic concept and theories as well as practical examples in the field of account, management of technology (MOT), decision-making theory, corporate finance, intellectual property and project management. Acquisition of integrated perspective of technical management for sustainable engineering with international competitive edge is expected.

[Outline (partly tentative)]

1. Fundamentals of Accounting
2. Accounting for Business Enterprise
3. Decision-Making Theory
4. Introduction to Microeconomics
5. Management of Technology (1)
6. Management of Technology (2)
7. Intellectual Property
8. Legal Operation of Patents (1)
9. Legal Operation of Patents (2)
10. Strategic use of Accounting
11. Introduction to Project Management
12. Risk Management of International Project
13. Enterprise Strategy for Globalization and Localization
14. International Technical Standard and International License for Engineer

99302

Sustainable Engineering Technology

Autumn Semester (1-1-0) (Every Year)

Coordinators of SEP and invited lectures

[Aims and scopes]

Sustainable Development has been secured by a various technologies. In this course, leading engineers and researchers will give lectures on a specific area which is crucial for sustainable development, such as, energy and environment, security, material production, and information technology. In addition to the lectures, the students

will investigate the relation of their specialty to the specific area by various ways, including site visits, and give presentations on the investigation to share the knowledge with the students of different specialty in a seminar. Through lectures and seminars with the discussions by the students of different disciplines, this course aims to train the students as “highly educated, internationalized engineers” having a wide spectrum of technical knowledge from basics to their applications. Details of lectures and seminar in the previous years are available in < http://www.eng.titech.ac.jp/ingp/sep/setss/ >

71049

Energy Systems and Environment

Spring Semester (2-0-0) (Even Years)

Assoc. Prof. Yukitaka KATO and Prof. Hiroshi UJITA

[Aims and scopes]

The lecture is given on the impact of energy use on global environment and the possibility of energy technologies on environmental protection. Energy technologies are reviewed from primary energy resources analysis, energy conversion and storage, and transportation systems to waste management. Advanced energy management technologies related with hydrogen, nuclear, fuel cell, battery and heat pump are introduced with exercises. The performance and limit of each technology will be shown, then, practical possibility of energy technologies will be known. Disputation on topics for energy and global environment within participants is also planned to widen personal understanding for what energy and environment are.

24047

Degradation of Infrastructure

Autumn Semester (1-0-0) (Odd Year)

Prof. Hiroshi KIHIRA, Dr. Tomonori TOMINAGA, Dr. Takanori NISHIDA and Dr. Takuyo KONISHI

[Aims]

Infrastructures as social capital founded in the period of high growth in Japan are being faced with severe degradation without appropriate maintenance and updating through the years of low growth and economic stagnation. The potential danger is eminent. On the other hand, developing and emerging countries in Asia urgently needs growing equipment of infrastructure. In this lecture, industrial experts in the front line of the field of material and civil engineering will introduce the present situation of degradation of infrastructure and the development of countermeasure technology in Japan, Europe and United States, as well as give a perspective of upcoming technologies in this field.

24051

Science of Materials

Autumn Semester (1-0-0) (Even Years)

Dr. Shiro TORIZUKA, Dr. Toshiyuki KOYAMA, Dr. Akihiro KIKUCHI, Dr. Eiji AKIYAMA

[Aims]

This course aims at introducing various materials in the aspect of science through many topics drawing attentions in developing high performance materials in the field of infrastructure, energy and environmental conscious materials, combined with computational simulation. The following four topics related to innovative materials and creation process are selected to provide fundamental knowledge and broad interest in the science of materials.

1. Cutting edge of ultra steels with high performance
2. Thermodynamics and kinetics for computational materials design
3. Evolution of superconductive materials
4. Development of anti-corrosion materials

35034

Chemical Engineering for Advanced Materials and Chemicals Processing I

Autumn Semester (2-0-0)

Prof. Hidetoshi SEKIGUCHI, Prof. Kazuhisa OHTAGUCHI, Assoc.Prof. Hideyuki MATSUMOTO and Assoc.Prof. Shinsuke MORI

[Aims]

This class covers fundamentals of energy transfer operations, chemical reaction engineering, and process systems engineering.

[Outline]

1. Introduction
2. Energy transfer operations (I)
3. Energy transfer operations (II)
4. Energy transfer operations (III)
5. Energy transfer operations (IV)
6. Homogeneous reactions in ideal reactors (I)
7. Homogeneous reactions in ideal reactors (II)
8. Flow patterns, contacting, and non-ideal flow
9. Reactions catalyzed by solids
10. Process system dynamics & modeling (I)
11. Process system dynamics & modeling (II)
12. Process system dynamics & modeling (III)
13. Process system dynamics & modeling (IV)

99349, 99350

Communication Skill in Japanese Industry I Autumn Semester (0-1-0) (Every Year)

Communication Skill in Japanese Industry II Spring Semester (0-1-0) (Every Year)

Coordinators of SEP and invited lectures

[Aims and Scope]

Required language and communication skills for the working environment in Japan vary depending on the types of industries and types of work. This class is designed for the students who are aiming or considering a job/internship opportunity in Japan. In this class, lecturers are invited from companies of various industries and the students have lectures about general introduction, working environment, especially language environment, and required communication/language skills of the companies. After having the lectures, the students visit a company to see actual working conditions. Through the studies in the class and the company visit, the students are expected to set their own targets of language ability at the time of internship and graduation based on their desired working place conditions. The student will also make her/his own study plan for promoting the language and communication skills with the guidance of instructors.

[Prerequisite]

This class is aiming to motivate the students in their own language study. To maximize the efficiency of the study in this class, the students should also take classes of Language Program, e.g., Japanese class in particular.

99441, 99492

International Research Program 1A Spring Semester (0-0-1) (Every Year)

International Research Program 1B Autumn Semester (0-0-1) (Every Year)

99443, 99494

International Research Program 2A Spring Semester (0-0-2) (Every Year)
International Research Program 2B Autumn Semester (0-0-2) (Every Year)
99445, 99496
International Research Program 3A Spring Semester (0-0-4) (Every Year)
International Research Program 3B Autumn Semester (0-0-4) (Every Year)
Coordinators of SEP

[Aims and Scope]

Through exchange agreements with overseas universities or other universities/institutions without an agreement, study abroad or an international research internship is undertaken to deepen knowledge and expertise related to global science and technology. By participating in an overseas internship, students can gain an understanding of society and lifestyles outside of Japan, which will give them an international perspective.

The number of credit is based on the period of overseas study as following:

Period of 1A and 1B (0-0-1): approximately **two weeks**.

Period of 2A and 2B (0-0-2): more **two weeks**.

Period of 3A and 3B (0-0-4): over **one month**

The students participating in this course are required to submit a report and give a presentation after completing the internship.

[Prerequisite]

Prior to the registration of the program, the student should submit the study plan and obtain the approval by the instructor.

5.1 Development and Environmental Engineering Course

70001

Principles of International Development Project

Spring Semester (0-2-0) (Every Year)

Assoc. Prof. Shinya HANAOKA, Prof. Nobuaki OTSUKI, Prof. Hirofumi HINODE, Prof. Jun-ichi TAKADA, Prof. Keisuke MATSUKAWA, Prof. Masakazu SASAKI, Prof. Manabu TSUNODA, Prof. Kiyohiko NAKASAKI, Prof. Manabu KANDA, Prof. Kunio TAKAHASHI, Prof. Shinobu YAMAGUCHI, Assoc. Prof. Ryuichi EGASHIRA, Assoc. Prof. Naoya ABE, Assoc. Prof. Hiroshi TAKAGI, Assoc. Prof. Yukihiko YAMASHITA and Dr. Tatsumi TOKUNAGA

[Aims]

This course aims to introduce the basic procedures and its principles of international development project mainly focusing on developing countries. The course also introduces potential implications of the engineering methods/approaches geared into international development.

[Outline]

Detailed outline will be announced on OCW-i.

70042

Mathematics and Statistics for International Development Engineering

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Yukihiko YAMASHITA

[Aims]

This course aims at introducing basic mathematics and statistics used in international development engineering in succession to those of undergraduate study. For mathematics, advanced liner algebra and optimization techniques are lectured. For statistics, characterizations of normal distribution, test and estimation are lectured.

[Outline]

1. Introduction and Eigenvalue problem
2. Singular value decomposition
3. Generalized inverses of matrices (Moore-Penrose generalized inverse)
4. Octave (Program for linear algebra calculation)
5. Maximum gradient method
6. Conjugate gradient method
7. Quasi-Newton’s method
8. Conditional optimization
9. Support vector machine
10. Probability
11. Normal distribution
12. Estimation and test
13. Cramer-Rao lower bound
14. Statistical learning theory

70037

International Development Projects Case－ Method

Autumn Semester (0-2-0) (Every Year)

Prof. Jun-ichi TAKADA and Prof. Shinobu YAMAGUCHI

[Aims]

This course aims at introducing practical approaches to development projects. Traditional teaching in the classroom

based on lectures and exams, often do not address the need for practical, problem-solving skills. The important and crucial ability for effective project management is the ability to think, analyze, discuss, and develop solutions to problems as professionals may encounter in the field. The case method is an effective approach to strengthening these skills.

[Outline]

1. Introduction to the course
2. Lecture/Discussion: Development & Human Development Indicator
3. Case Method 1: “Ideal and Reality of Project for the Minority People by the Minority People”
4. Lecture/Discussion: Rural Development and Participation Approach
5. Case Method 2: “International Collaboration in Developing Countries”
6. Lecture/Discussion: Rural Development Participation
7. Paper Writing
8. Case Method 3: “Academic Cooperation Program with Thailand”
9. Lecture/Discussion: Risk Management of Technological Change
10. Case Method 4: “Polio Immunizaion in Lang Tang Province”
11. Lecture/Discussion: Community Development
12. Case Method 5: “Run before You Get Shot down?”
13. Group Presentation/Paper Writing

70002

Environmental Engineering in International Development

Autumn Semester (2-0-0) (Odd Years)

Prof. Hirofumi HINODE, Prof. Masakazu SASAKI and Prof. Manabu KANDA

[Aims]

This lecture outlines international environmental problems from the engineering side.

[Outline]

1. Introduction
2. Population Growth
3. Air Pollution
    1) Aid Rain
    2) Ozone Depletion
    3) Global Warming
4. Marine Pest
5. Deforestation and Desertification
6. Energy Problem
    1) Fossil Fuel Energy and New Energy
    2) Energy Saving
7. Waste Management
    1) Recycling
    2) Eco-business

61062

Advanced Technical Communication Skills: ATC I

Spring Semester (1-1-0) (Every Year)

Prof. David B. STEWART

[Aims and Scope]

In this roundtable seminar we intend to identify and improve skills in academic writing (i.e., those used for technical journals) and also to improve oral presentation techniques, assisted by Power Point or similar media.
[Outline]
The basic approach to technical writing in the fields of engineering and the sciences is unified. It can be learned through content analysis and close attention to style. Each journal has its own house requirements. Still, the structure of all peer-reviewed research follows what is referred to as IMRaD: Introduction, Methods, Results, and Discussion. You describe (1) what you did and (2) why you did it; then you tell (3) how you did it and (4) what you found out. Finally, you must explain clearly what all this means for your readers.
You will learn to be clear and logical in approach and to write from the point of view of a prospective reader. This is not a translation course. On the contrary, *you will be encouraged to think and write in English.* In presentation, you'll be requested to speak so that you can be heard and also to make your visual materials uniform and consistent, as well as attractive, effective, and persuasive. All this takes hard work and for some students may at first feel unfamiliar. To achieve your aims, you must take risks, make mistakes, and then start again. To do this, we must meet twice a week on a regular basis and you will spend a certain amount of time outside class in preparation.

61063

Advanced Technical Communication Skills: ATC II

Autumn Semester (1-1-0) (Every Year)
Prof. David B. STEWART
[Aims and Scope]
In this roundtable seminar we intend to identify and improve skills in academic writing (i.e., those used for technical journals) as well as to improve oral presentation techniques, assisted by Power Point or similar media.
[Outline]
This seminar is a continuation of ATC 1. (NOTE: new students are accepted in both terms.)
Requirements are identical and students are will proceed at their own pace within the context of what the group achieves. Students themselves, as well as the instructor, will provide constructive criticism and overall support for everyone's work. Class meeting times are the same as in the spring term, and regular attendance is both compulsory and vital to your success.

61071

International Collaboration I

Spring Semester (0-1-0) (Every Year)
Prof. Junichiro NIWA
[Aims and scope]
Through collaborative works on earthquake hazard prediction and mitigation for the home countries of the student and discussions on the related issues, such as the strategy of urban earthquake disaster prevention, the student will foster the ability of international communication, negotiation, collaboration, and leadership.

61072

International Collaboration II

Autumn Semester (0-1-0) (Every Year)
Prof. Junichiro NIWA
[Aims and scope]
Through collaborative works on the project evaluation related to earthquake hazard prevention for the specific region and discussions on the related issues, the student will foster the ability of international communication, negotiation, collaboration, and leadership.

77048

Advanced Course on Coastal Environments

Spring Semester (2-0-0) (Even Years)

Prof. Kazuo NADAOKA

[Aims and Outline]

I. Coastal zone is subjected to large environmental impacts as well as various natural phenomena such as waves and currents. Theories and numerical simulation methods related to these aspects will be lectured with some recent topics on the improvement of coastal environments.

II. 1. Physics of Water Waves:
Basic Theory/Nonlinear Wave Theories/Wave Breaking and Related Phenomena/Wind Waves and Random Waves/Various Wave Models and Numerical Simulation
2. Physics of Coastal Currents: Nearshore Currents/Tidal and Ocean Currents
3. Nearshore Sediment Transport and Beach Deformation: Mechanism of Sediment Transport/ Budget of Sediment Transport Rate and Resultant/ Beach Deformation/Control of Littoral Drift
4. Environmental Hydraulics in Coastal Zone: Introduction/Physical Environments in Coastal Zone/Control and Improvement of Coastal Environments

70009

Regional Atmospheric Environment

Autumn Semester (1-0-0) (Every Year)

Prof. Manabu KANDA

[Aims and Scopes]

The purpose of this lecture is twofold. One is to understand the fundamental knowledge and theoretical concepts of Boundary-Layer Meteorology (BLM). The other is to review the recent applications of BLM to physical urban planning and civil engineering.

[Outline]

1. Basic theory of Atmospheric Boundary Layer
   - 1.1 Definition of Atmospheric Boundary Layer
   - 1.2 Diurnal Change of Atmospheric Boundary Layer
   - 1.3 Constant Flux Layer
   - 1.4 Turbulent Transfer Process
   - 1.5 Radiative Transfer
   - 1.6 Energy Balance of Ground Surface
2. Application to Physical Urban Planning
   - 2.1 Mesoscale Circulation
   - 2.2 Heat Island Phenomena
   - 2.3 Micrometeorology of Forest Canopy
   - 2.4 Micrometeorology of Urban Canopy
   - 2.5 Energy Balance of Human-body
   - 2.6 Numerical Prediction of Urban Climate

61073

Aquatic Environmental Science

Spring Semester (2-0-0) (Even Year)

Asso. Prof. Chihiro YOSHIMURA

[Aims and Scope]

This lecture is given to provide the fundamentals to understand aquatic ecosystems and their applications to assess aquatic environments for sustainable management. The fundamentals include aquatic chemistry, biogeochemistry, and aquatic ecology, which are common for freshwater and saltwater systems. The applied aspects emphasize freshwater ecosystems in relation to river environmental management.

[Outline]

1. Major compounds in natural water
2. Basic analytical chemistry (1)
3. Basic analytical chemistry (2)
4. Acidity of water
5. Oxidation and reduction
6. Dissolution and deposition
7. Particles and colloids
8. Nutrient cycles
9. Organic carbon dynamics
10. Contaminant behavior
11. Primary production
12. Microbial decomposition
13. Trophic relationships
14. Biodiversity and ecological disturbance

[Evaluation] Attendance, Assignments, Examination

[Texts] Aquatic Environmental Chemistry (Oxford, 1998).

[Related subjects] Water Management for Environmental Health

61074

Environmental Statics

Spring Semester (2-0-0) (Odd Year)

Asso. Prof. Chihiro YOSHIMURA

[Aims and Scope]

This lecture is given to provide common statistical skills to analyze and interpret data sets obtained in environmental science and engineering. Main topics are sampling design, hypothesis testing, multivariate analysis, and time series analysis. Students are required to work on exercises to promote theoretical understanding.

[Outline]

1. Hypothesis and sampling design
2. Probability distribution
3. Hypothesis test
4. Simple regression analysis
5. Multiple regression analysis
6. Data transformation
7. Analysis of variance (1)
8. Analysis of variance (2)
9. Multivariate exploratory technique (1)
10. Multivariate exploratory technique (2)
11. Multivariate exploratory technique (3)
12. Nonparametric analysis
13. Time series analysis

14. Monte-Carlo method

[Evaluation] Attendance, Assignments, Examination

[Texts] Handouts will be provided by the lectures.

61082

Water Quality Dynamics

Autumn Semester (2-0-0)（Even Years）

Assoc. Professor Chihiro YOSHIMURA

[Aims and Scope]

This lecture provides essential knowledge on water quality dynamics and its modeling techniques both in water environments and water treatment facility together with updated examples. Thus, it will support students to understand detailed water quality processes and build numerical frameworks (water quality models) for study fields or facilities of your interest.

[Outline]

1. Major components in natural water and their units
2. Advection
3. Diffusion and dispersion
4. Aquatic chemistry
5. Kinetics
6. Liquid-solid interface
7. Dissolved oxygen and reactive oxygen
8. Microbial reactions
9. Carbon dynamics
10. Nutrient dynamics
11. Pathogens and toxics
12. Available water quality models

61080

GIS in water resources engineering

Autumn Semester (1-1-0) (Every Year)

Assoc. Prof. Oliver C. SAAVEDRA V.

[Aims and Scope]

This lecture supports students to get benefit from Geographical Information Systems（GIS）tools in water resources engineering. It introduces concepts of spatial coordinate systems, and raster and vector data types. The procedures of surface analysis using Digital Elevation Models（DEM）to the watershed delineation, including river networks are studied. In addition, the preparation of input data for hydrological models is applied. Actually, this includes the usage of advanced on-site observations, remote sensing sources handled by GIS. Then, different applications in water supply and water management are reviewed. Finally, a final project should be presented by students applying GIS. Hands-on learning followed by theory introduction is expected.

[Outline]

1. Introduction to GIS
2. Application of Geographic Information Systems in Water Resources
3. GIS data and database
4. Coordinate systems and geocoding
5. GIS analysis functions
6. GIS operations and management

7. GIS for surface-water hydrology
8. How to delineate a watershed from a DEM
9. How to prepare Soil and land-use data
10. How to prepare precipitation data
11. GIS for groundwater hydrology
12. GIS for water supply
13. GIS for floods and droughts
14. Application of remote sensing data in Hydrology

61079

Advanced Hydrology and Water Resources Management

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Oliver C. SAAVEDRA V.

[Aims and Scope]

This lecture covers topics related to hydrological modeling, water resources engineering and management. It introduces physically-based hydrological models as a tool for water assessment and decision support. Actually, the characteristics of input data to these models are reviewed. Optimization techniques in water resource are also introduced. Then, water management experiences from different regions of the world are reviewed. Finally, the concepts of integrated water management are updated.

[Outline]

1. The water cycle and its main processes
2. Physically-based hydro-meteorology
3. Monitoring of hydro-meteorology
4. Remote sensors used in Hydrology
5. Introduction of optimization algorithms
6. Application of optimization algorithms in water resources
7. Structural Flood control in South East Asia
8. Non-structural Flood control in South East Asia
9. Nile River water resources, Egypt
10. Water scarcity in La Plata Basin, South America
11. Water uses and withdraws in the USA
12. Water for Hydropower generation
13. Management concepts in water
14. Integrated water resources experiences

61085

Water Resource Systems

Spring Semester (2-0-0) (Every Year)

Prof. Shinjiro KANAE

[Aims and Scope]

This subject provides an opportunity to study contemporary major topics in water resource systems, based on the introduction to dynamics, statistics, monitoring, and modeling of terrestrial water cycle on global, regional, and basin scales. Here, water cycle includes the anthropogenic impacts like water withdrawal, reservoir operation, and human-induced climate change. Through the presentation and discussion, participants are expected to obtain perspective for the analysis, design and management of water systems.

[Outline]

The topics covered in this lecture are:

1. Flood and drought risks
2. Impact of climate change and adaptation to it
3. Water conflict and management
4. Nexus of water, food, and energy
5. Land-use/land-cover change and water cycle

Each topic will be covered by a couple of lectures. Your presentations and discussions in English based on recent articles on hydrology and water resources will form an important part of this class.

[Evaluation]

Assignment, examination, presentation, and discussion. Details will be explained in the class.

[Texts]

Handouts and necessary material will be provided in the class.

98053

Open Channel Hydraulics

Spring Semester (1-0-0) (Every Year)

Prof. Tadaharu ISHIKAWA

[Aims and Scope]

Open Channel Hydraulics is a branch of applied fluid mechanics to support river management and improvement works for flood disaster prevention and water environment conservation. The first half of the lecture provides the fundamentals; general transport equation being based on the idea of conservation law, and basic characteristic of one dimensional open channel flow by using the energy transport equation. The second half of the lecture provides practical features of open channel hydraulics; hydraulic jump, composite channel flow, secondary flow, sedimentation and salt wedge dynamics in estuaries.

98067

Environmental Hydraulics

Spring Semester (1-0-0) (Every Year)

Assoc. Prof. Takashi NAKAMURA

[Aims and Scope]

In this lecture, the fundamental aspects of environmental water flows are explained based on the fluid mechanics. In particular, as introduction, derivation of some partial differential equations governing the water flow is explained in detail, and based on their equations, some basic features of the water flow are discussed. Then, as listed below, several important phenomena observed in actual environmental water flows are taken up, and their interesting features are discussed being based on mathematical analysis of the fluid mechanics.

[Outline]

1. Mechanism of flow instability.
2. Physics of water surface wave.
3. Features of density current (Instability, Internal wave).
4. Mathematical modeling of turbulent effects for the environmental water flows.

98060

Watershed Hydrology

Spring Semester (1-0-0) (Every Year)

Prof. Tsuyoshi KINOUCHI

[Amis and Scope]

This course focuses on the watershed scale hydrology to understand the movement of water through the hydrologic cycle in relation to environmental characteristics of watersheds. The course covers basic principles to hydrology and the mathematical description of underlying hydrologic processes. We also learn specific hydrologic models and their applications. In some sessions we pick up a set of papers and assigned students are required to present the summary of each paper including the objective, concept, methodology and findings. All the students are expected to participate in the discussion.

[Outline]

1. Introduction
2. Atmospheric water
3. Subsurface water
4. Surface flow
5. Groundwater hydrology
6. Urban hydrology
7. Statistical methods in hydrology

61049

Geo-Environmental Engineering

Spring Semester (2-0-0) (Every Year)

Assoc. Prof. Jiro TAKEMURA

[Aims and Scope]

Various aspects on soil contamination and waste disposal system, i.e., laws, fundamental theories and technologies, will be explained.

[Outline]

1. Introduction
2. Characteristics of ground water and geochemistry (I)
3. Characteristics of ground water and geochemistry (II)
4. Ground contamination (I) -- mechanism
5. Ground contamination (II) -- physical laws
6. Various contaminants, sources of ground contamination and environmental laws
7. VOC's and NAPLs
8. Partitioning, Sorption of contaminant
9. Remediation of contaminated sites
10. Basic knowledge of solid waste management & landfill
11. Onshore and offshore waste disposal landfills
12. Landfill liner and cover
13. Transient process of contaminant migration through liner, Monitoring
14. Radio active wastes
15. Site Visit

[Evaluation] Attendance, Assignments, examination

[Texts] Handouts will be provided by the lectures.

[Prerequisites] None

61061

Physical Modelling in Geotechnics

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Jiro TAKEMURA and Akihoro TAKAHASHI

[Aims and Scope]
This course covers scaling laws and modeling considerations for physical modeling in geotechnical problems both for static and dynamic conditions with laboratory exercises.
[Outline]
1. Introduction + visit TIT geotechnical centrifuge facilities
2. Similitude and modeling principles
3. Design of physical model and model ground preparation
4. Modeling exercise -1: preparation of dry sand model ground
5. Measurements strategy and sensors.
6. Modeling exercise -2: Modeling of liquefaction in 1 G field
7. Modeling exercise -2: continue
8. Recent developments in physical modeling - foundation
9. Recent development in physical modeling - excavation
10. Recent development in physical modeling - dynamic problems
11. Modeling exercise -3: Response of a single pile in sand during earthquake in a centrifuge
12. Modeling exercise -3: continue
13. Resent development in physical modeling - cold regions' problem
14. Examination and interview

[Evaluation] Assignments, Exercise, Examination
[Texts] Handouts on each topic will be provided by lecture.
[Prerequisites] None

61014

Advanced Mathematical Methods for Infrastructure and Transportation Planning

Spring Semester (2-0-0) (Odd Years)
Assoc. Prof. Daisuke FUKUDA
[Aims]
(1) To learn about the theory and application of the "Discrete Choice Model (DCM)" which has been widely used in travel demand forecasting.
(2) To learn about the practice of DCM through some computer exercises using the data on transportation, telecommunication, energy and marketing.

[Outline]
1. Choice Behavior and Binary Choice Models
2. Estimation of Binary Choice Models
3. Exercise (1): Estimation of BCM
4. Multinomial Choice Models: Logit and Probit
5. Specification and Estimation of Multinomial Logit Model
6. Exercise (2): Estimation of MNL
7. Statistical Testing of DCM
8. IIA, Forecasting and Microsimulation
9. Exercise (3): Statistical Testing & Forecasting
10. Nested Logit Model (NL)
11. Multivariate Extreme-Value Model (MEV) & Sampling Issues
12. Exercise (4): Estimation of NL & MEV
13. Mixed Multinomial Logit Model (MXL) & Monte Carlo Integration
14. Exercise (5): Estimation of MXL

[Evaluation] Attendance and Home Work Assignments
[Text] Lecture materials will be provided by the lecturer.

61081

Transportation Network Analysis

Autumn Semester (2-0-0) (Even Years)
Prof. Yasuo ASAKURA
[Aims and Scope]
Mathematical formulation and solution algorithms for User Equilibrium models in transportation networks are described based on the nonlinear optimization framework. A variety of UE models are introduced including deterministic UE model with fixed OD demand and stochastic UE model with variable OD demand. Possible applications of those models to transportation planning are also discussed.
[Outline]
1. Roles of transportation network analysis
2. Nonlinear optimization theory
3. Solution algorithms
4. User Equilibrium model with fixed OD demand
5. User Equilibrium model with variable OD demand
6. Stochastic User Equilibrium
7. Application of UE models

61066

Transportation Economics

Autumn Semester (1-0-0) (Even Years)
Assoc. Prof. Daisuke FUKUDA
[Aims and Scope]
This course is designed to introduce graduate students with engineering background a solid grounding in the economic analysis of transportation.
[Outline]
1. Consumer behavior theory
2. Theory of the firm
3. Transportation costs
4. Congestion pricing: Theory
5. Congestion pricing: Practice
6. Benefit-Cost Analysis of Transport Facilities
[Evaluation]
Attendance and Home Work Assignments
[Texts]
Lecture materials will be provided by the lecturer.

92047

Theory of Regional Planning Process

Spring Semester (2-0-0) (Even Years)
Prof. Tetsuo YAI
[Aims and scope]
The systems of Regional Planning and Transportation Planning are studied in this class. To achieve the goal, first we

learn about the systems of those planning in Europe, USA and Japan, second we study on the fundamental principle of planning procedures and institutions. Then, we discuss on the citizen participatory process for those planning fields. This class will cover some parts of administrative court systems and strategic environmental assessment in other countries. Planning practices will be discussed during the class.

[Outline]

1. Overview
2. National and Regional Planning systems in Japan
3. Planning systems in Europe and USA
4. Fundamental theory of planning procedure
5. Public Involvement process
6. Administrative court system
7. Planning and SEA

92048

Environmental Transportation Engineering

Autumn Semester (1-0-0) (Odd Years)

Prof. Tetsuo YAI

[Aims and scope]

This class covers transportation systems such as aviation, expressway, highway, public transport, and bicycle. The environmental improvements related to those systems are focused and advanced topics on the analytical tools are discussed in the class.

[Outline]

1. Outline
2. Regional Environment and Microscopic Road Simulation
3. Safer network environment and Driving Simulator
4. Quality of life and public transport systems
5. Non-motorized transport and urban environment
6. Air navigation System and global warming problem

[Evaluation]

Report

[Texts]

Handouts will be provided through laboratory’s web.

92035

City/Transport Planning and the Environment

Autumn Semester (1-0-0) (Every Year)

Assoc. Prof. Yasunori MUROMACHI

[Scope]

Following introduction, this course focuses on air pollution, global warming, noise and other elements of the environment which city/transport planning should cover. Theoretical issues such as externality and public goods as well as practical concerns such as EIA are also discussed.

[Outline]

1. Air Pollution
2. Global Warming
3. Noise
4. Other Elements of the Environment

5. Basics of Environmental Economics
6. Measures for Protecting the Environment

[Evaluation]
Attendance and Home Work Assignments
[Texts]
Lecture materials will be provided by the lecturer.

61034

Stability Problems in Geotechnical Engineering

Autumn Semester (2-0-0) (Every Year)
Assoc. Prof. Akihiro TAKAHASHI, Assoc. Prof. Jiro TAKEMURA and Prof. Masaki KITAZUME
[Aims and Scope]
The lecture focuses on various approaches to stability problems in geotechnical engineering, including limit equilibrium method, limit analysis and slip line method. The lecture also covers soil-structure interaction problems, seismic stability problems and recent ground improvement methods for increasing the stability of the structures.
[Outline]

1. Introduction
2. Stability analysis
    1) limit equilibrium
    2) limit analysis
    3) slip line method
3. Soil-Structure Interaction problems
    1) pile-soil interaction
    2) braced wall excavation
4. Underground construction
5. Soil improvements & reinforcement
6. Design philosophy and design code

[Evaluation] Attendance, Assignments and Examination
[Texts] Handouts will be provided by the lectures.
[Prerequisites] None

61038

Mechanics of Geomaterials

Spring Semester (2-0-0) (Every Year)
Prof. Masaki KITAZUME
[Aims and Scope]
Explain mechanical behaviour of various geomaterials
[Outline]

1. Behaviour of grains and packing of granular materials
2. Stress space and failure criteria
3. Micro-scopic view of geo-materials
4. Sampling and disturbance
5. Behaviour of naturally deposit soils
6. Behaviour of improved geo-materials
7. Behaviour of reinforced geo-materials
8. Time dependent behaviour of geo-materials

9. Constitutive equations

[Evaluation] Assignments, Examination, interview

[Texts] Handouts on each topic will be provided by lectures.

[Prerequisites] None

70043

Advanced Concrete Technology

Autumn Semester (2-0-0) (Every Year)

Prof. Nobuaki OTSUKI

[Aims and Scopes]

Lectures on the state of the art of concrete technology will be presented, including some topics related to developing countries.

[Outline]

1. Introduction
2. Cementitious materials－past, present and future
3. Structure of hardened concrete
4. Strength
5. Cements (1)
6. Cements (2)
7. Admixtures (1)
8. Admixtures (2)
9. Aggregates
10. Light weight Aggregates
11. Flowable concrete, including anti-washout concrete
12. Pre-stressed concrete
13. Durability
14. Maintenance

[Evaluation] By examination

[Texts] Ref. Concrete, Prentice Hall

[Prerequisites] None, however, basic knowledge of undergraduate level may be necessary.

61003

Mechanics of Structural Concrete

Spring Semester (2-0-0) (Odd Years)

Prof. Junichiro NIWA

[Aims and Scopes]

Fundamental mechanical behaviors of structural concrete will be explained.

Some concepts for the limit state design method will also be given.

[Outline]

1. Introduction
2. Structural Design Concept of Concrete Structures
3. Ultimate Limit States
   - 3.1 Flexural Capacity of RC Members
   - 3.2 Capacity of RC Members Subjected to Combined Flexural Moment and Axial Force
   - 3.3 Shear Capacity of RC Members
   - 3.4 Application of Fracture Mechanics

3.5 Size Effect in Diagonal Tension Strength
3.6 Lattice Model Analysis
3.7 Torsion Capacity of RC Members
4. Serviceability Limit State
5. Fatigue Limit States
6. Special Topics

[Evaluation] Attendance, Reports and Examination
[Text] Lecture notes will be provided by the lecturer.
[Prerequisites] None

70041

Utilization of Resources and Wastes for Environment

Autumn Semester (2-0-0) (Every Year)
Prof. Nobuaki OTSUKI, Prof. Kiyohiko NAKASAKI and Assoc. Prof. Ryuichi EGASHIRA
[Aim]
In order to achieve "sustainability" in our society, we have maximized resources productivity (product generated per unit resources) in industrial activities and minimized material/energy load (wastes) to the environment. In addition, wastes have been reused and recycled properly, even if wastes are generated. This lecture provides several examples of such industrial processes and technologies as above which effectually utilize resources and wastes.
[Outline]

1. Introduction and fundamental information about waste
2. Activities in construction industries
3. Activities in cement and concrete field (1)
4. Activities in cement and concrete field (2)
5. Bio-refinery (1)
6. Bio-refinery (2)
7. Solid waste treatment (1)
8. Solid waste treatment (2)
9. Cascade biomass use
10. Petroleum refinery (1)
11. Petroleum refinery (2)
12. Petroleum refinery (3)
13. Water treatment
14. Summary

61083

Maintenance of Infrastructure

Spring Semester (2-0-0) (Even Years)
Prof. Mitsuyasu IWANAMI
[Aims and Scopes]
It is of importance to appropriately maintain our infrastructure, that is constructed to achieve comfortable and safe life and integrated economical activity. In the lecture, basic concept of appropriate maintenance, constituent technology such as inspection, evaluation, prediction, and countermeasure, linkage with structural design are explained. Furthermore, recent examples of infrastructure maintenance are analyzed as case studies, aiming to acquiring the relevant knowledge.
[Outline]

1. Introduction
2. Objective of maintenance
3. Basic concept of maintenance
4. Inspection and investigation
5. Performance evaluation and its future prediction
6. Repair and reinforcement
7. Linkage with structural design
8. Case studies (recent example of maintenance)

[Evaluation]
Attendance and Reports
[Text]
None(some handouts are distributed by the lecturer if necessary)
[Prerequisites]
None

61005

Fracture Control Design of Steel Structures

Autumn Semester (2-0-0) (Even Years)
Assoc. Prof. Eiichi SASAKI
[Aims]
Damage cases in steel structures are categorized and the control design concepts for fracture are lectured.
[Outline]

1. Classification of Fracture Modes if Steel Structures
2. Damage Cases I Steel Structures during Earthquakes
3. Fundamental Concepts of Fracture Mechanics
4. Fracture Toughness of Steels
5. Predominant Factors of Brittle Fracture
6. Fatigue Strength of Structural Elements
7. Nominal Stress Based Fatigue Design
8. Structural Stress Based Fatigue Design
9. Quality Control of Structural Elements
10. Fatigue Strength Improvement Methods
11. Maintenance of Steel Bridges
12. Characteristics and Prevention of Brittle Fracture during Earthquakes
13. Lessons learned from Failure
14. Discussions: Case Studies

[Evaluation] 5 Reports (50%), Examinations (50%)

77019

Analysis of Vibration and Elastic Wave

Spring Semester (2-0-0) (Odd Years)
Prof. Sohichi HIROSE
[Aims]
Theories of vibration and elastodynamic waves will be introduced and some engineering applications are presented.
[Outline]

1. Theory of wave and vibration for one dimensional problem

1-1. Fundamental equations
1-2. Reflection and transmission
1-3. Dispersive waves
1-4. Fundamental solutions and integral formulation

2. Theory of elastodynamics
2-1. Fundamental equations
2-2. Reflection and transmission of plane waves
2-3. Surface waves
2-4. Fundamental solutions and Green's functions
2-5. Integral representation of elastic waves
2-6. Numerical analysis of elastic waves

3. Engineering applications of wave and vibration
3-1. Application in seismic engineering
3-2. Application in nondestructive testing

[Evaluation] Report (20%) and Examination (80%)

61065

Introduction to Solid Mechanics

Spring Semester (2-0-0) (Every Year)

Assoc. Prof. Anil C. WIJEYEWICKREMA

[Aims]

The course is designed for the students to attain the following four objectives:

(1) Understand index notation used in equations in any subject area.
(2) Understand the fundamentals of stresses and strains.
(3) Obtain a good knowledge of linear elasticity.
(4) To be able to formulate and solve basic problems in solid mechanics.

[Outline]

1. Mathematical preliminaries -- Index notation
2. Mathematical preliminaries -- Vectors and Cartesian tensors
3. Mathematical preliminaries - Eigen-value problems, vector and tensor calculus
4. Stress and strain - Stresses, traction and equilibrium equations
5. Stress and strain - Principal stress and maximum shear stress
6. Stress and strain - Strain tensor
7. Stress and strain - Cylindrical polar coordinates
8. Stress and strain - Spherical coordinates
9. Linear elasticity? Hooke's law
10. Linear elasticity? Introduction to anisotropic elasticity
11. Elastostatic plane problems - Classification of two-dimensional elasticity problems
12. Elastostatic plane problems - Airy stress functions
13. Elastostatic plane problems - Infinite plate problem and Kirsch solution
14. Elastostatic plane problems - Infinite plane with a uniform body force in a circular region
15. Elastostatic plane problems - Hertz solution

[Evaluation] Homework - 20%, Quizzes - 20% and Final exam - 60%

[Texts] Timoshenko, S. P. and Goodier, J. N., 1970, "Theory of Elasticity", 3rd edition, Mc-Graw-Hill, New York / Barber, J. R., 2002, "Elasticity", 2nd edition, Kluwer, Dordrecht.

[Prerequisites] None

61048

Advanced Course on Elasticity Theory

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Anil C. WIJEYEWICKREMA

[Aims and Scope]

Non-linear elastic behavior is studied in detail. Anisotropic elasticity will also be introduced.

[Outline]

1. Finite Elastic Deformations -- Mathematical preliminaries (Cartesian tensors)
2. Finite Elastic Deformations -- Mathematical preliminaries (Tensor algebra)
3. Finite Elastic Deformations -- Kinematics (Configurations and motions)
4. Finite Elastic Deformations -- Kinematics (Deformation gradient and deformation of volume and surface elements)
5. Finite Elastic Deformations -- Kinematics (Strain, stretch, extension and shear)
6. Finite Elastic Deformations -- Kinematics (Geometrical interpretation of the deformation)
7. Analysis of motion -- Deformation and strain rates
8. Balance laws
9. Stress tensors -- Cauchy stress tensor
10. Stress tensors -- Nominal stress tensor
11. Conjugate stress analysis
12. Constitutive laws
13. Anisotropic Elasticity -- Linear anisotropic elasticity
14. Anisotropic Elasticity -- Lekhnitskii formalism
15. Anisotropic Elasticity -- Stroh formalism

[Evaluation] Home Work Assignments and Examination

[Texts] Holzapfel, G. A., 2001, “Nonlinear solid mechanics”, John Wiley, Chichester.

Ogden, R. W., 1984, “Non-linear elastic deformations”, Ellis Horwood, Chichester, also published by Dover publications, New York in 1997. Ting, T. C. T., 1996, “Anisotropic elasticity”, Oxford University Press, New York.

[Prerequisites] Students should have previously followed a course on Fundamentals of Elasticity or Introduction to Solid Mechanics.

61046

Principles of Construction Management

Autumn Semester (2-0-0) (Odd Years)

Prof. Atsushi HASEGAWA

[Aims and Scopes]

Considering international construction projects, elements of construction/project management will be lectured focusing on basic knowledge/skills/methodology, such as scheduling, cost management, risk management, bid, contract, legal issues, and project cash flow.

[Outline]

1. Course Introduction/ General Flow and Scheme of Construction Project (1)
2. General Flow and Scheme of Construction Project (2), - Bid/Contract (1)
3. Bid/Contract (2)
4. Time Management (1)
5. Time Management (2)
6. Cost Management (1)

7. Cost Management (2)
8. Estimation
9. Project Funding / Cash Flow
10. Special Topics on Management (1), - Client Management -
11. Risk Management
12. Legal Issue, Claim (1)
13. Legal Issue, Claim (2)
14. Special Topics on Management (2), - Project Case - / Course Closure

[Evaluation]
Final Report (50%) + Exercise (30%) + Participation (20%)
[Text] “Construction Management” by Daniel Halpin/ “A Guide to the Project Management Body of Knowledge” by PMI
[Prerequisites] None

61047

Probabilistic Concepts in Engineering Design

Autumn Semester (2-0-0) (Odd Years)
Assoc. Prof. Eiichi SASAKI
[Aims and scope]
This course enhances fundamental understandings on probabilistic approach for engineering design. Engineers must make an optimal decision with unknown or uncertain parameters. For the purpose of smart, reasonable and reliable design, this course provides quite important materials.
This course aims 1)to develop profound learning about reliability and safety on structural design and
2)to understand designing methods invoking probabilistic approach.
[Outline]
1. Introduction
2. Role of probability in Engineering Design
3. Design and Decision Making Under Uncertainty
4. Basic probability Concepts
5. Analytical Models of Random Phenomena
6. Functions of Random Variables
7. Estimating Parameters form Observations
8. Empirical Determination of Distribution Models
9. Decision Analysis
10. Statistics of Extremes
11. Reliability and Reliability Based Design

[Text]
Probability Concepts in Engineering Planning and Design Volume 1 and Volume 2, A.H. Ang and W.H. Tang
John Wiley & Sons
[Prerequisites] None

61013

Civil Engineering Analysis

Autumn Semester (2-0-0) (Every Year)
Prof. Sohichi HIROSE
[Aims]

Lecture on fundamentals of forward and inverse analyses of initial and boundary value problems in civil engineering
[Outline]

1. Introduction – forward and inverse problems
2. Variational method 1
3. Variational method 2
4. Variational method 3
5. Weighted residual method
6. Finite element method 1
7. Finite element method 2
8. Boundary element method 1
9. Boundary element method 2
10. Numerical implementation
11. Linearized inverse problems
12. Generalized inverse matrix
13. Instability and regularization of inverse problems

[Evaluation] Report (20%) and Examination (80%)

70020

Rural Telecommunications

Autumn Semester (2-0-0) (Every Year)
Prof. Jun-ichi TAKADA and Assoc. Prof. Takahiro AOYAGI
[Aims]
Information and communication technologies enable the transfer of information instantly between any points in the world. Moreover, it has become common understanding that the ICT infrastructure is indispensable for the development of the industry and economy. However, the reality is very severe in the developing world, especially in rural and remote areas. Imbalance of the distribution of ICT infrastructure in the world has been intolerable for the long time. This lecture overviews the history, technologies and applications of ICT infrastructure in rural and remote areas, both in the social and the technical aspects.
[Outline]

1. Introduction
2. Historical Aspects of Telecommunications 1 - Missing Link -
3. Historical Aspects of Telecommunications 2 - 20 years after Missing Link -
4. Communication technology
5. Information Technology and Internetworking
6. Free and Open Source Software
7. Access Infrastructure 1 - Cellular Systems -
8. Access Infrastructure 2 - Satellite Systems -
9. Access Infrastructure 3 - Wireless Computer Network -
10. Backbone Infrastructure - Optical link, Wireless backhaul, Satellite -
11. E-learning 1 - Overview and Theory
12. E-learning 2 - Instructional Design
13. E-learning 3 - Information and Communication Technology
14. E-learning 4 - Law and Economy
15. E-learning 5 - Case study
16. Case Presentation (in place of final exam)

70014

Chemical Process for Development

Autumn Semester (1-0-0) (Every Year)

Assoc. Prof. Ryuichi EGASHIRA

[Aims]

The viable applications of chemical unit process or operation for development are introduced through relatively new examples related to waste, water treatments, and energy.

[Outline]

1. Introduction
2. View of Chemical Process for Development
3. Waste Treatment - Process for Management of Solid Waste in Developing Regions
4. Water Treatment - Decolorization of Wastewater from Sugarcane Factory
5. Water Treatment - Removal and Recovery of Metals, Organic Compounds, etc. from Water Using Liquid Phase Equilibrium
6. Energy - GTL (gas-to-liquid): Chemical Liquefaction of Natural Gas
7. Energy - Biofuel Process

70031

Welding and Joining Technology

Spring Semester (2-0-0) (Every Year)

Prof. Kunio TAKAHASHI

[Aims]

Welding and joining processes are the key technology in the industry. The processes will be reviewed including recent advanced processes. Phenomena and mechanisms of the processes will be explained based on material science, mechanics, and electrical engineering.

[Outline]

1. History of welding and joining processes
2. Required condition for welding and joining processes
3. Method and its classification
4. Arc welding phenomena
5. Arc welding power sources and equipments
6. Cutting
7. Materials and their behavior in welding and joining
8. Metallurgy of steel and heat treatment
9. Heat input and cooling rate
10. Weld defects
11. Mechanical properties of weld joints
12. Residual stress and weld deformation
13. Weld design

70032

Perspective Understanding of Various Kinds of Material

Autumn Semester (2-0-0) (Every Year)

Prof. Kunio TAKAHASHI

[Aims]

Material properties such as latent heat, electric conductance, diffusion coefficient, elasticity, strength, etc... will be

explained for variety of materials such as metals, ceramics, semiconductors, concretes, composites, etc... from the universal view point using bases of quantum mechanics, statistical mechanics, thermo-dynamics, etc...
[Outline]

1. Physics for an universal feature of materials
2. Electric properties of materials
3. Mechanical properties of materials
4. Thermal properties of materials
5. Chemical properties of materials
6. Metals
7. Insulators
8. Semi-conductors
9. Ceramics
10. Carbon steels
11. Concrete

70029

Introduction to Economics for Engineers

Spring Semester (2-0-0) (Every Year)
Assoc. Prof. Naoya ABE
[Aims]
This course aims to provide basic concepts and theories of microeconomics (and limited parts of macroeconomics) to potential engineering graduate students who have no economics background for their easy (and not complete) access to current economic topics and the fields of applied economics such as environmental economics and development economics.
[Outline]

1. Introduction
2. Consumer theory: preferences, indifference curves and utility function
3. Consumer theory: types of goods and price indices
4. Consumer theory: elasticity, price& income effects
5. Consumer theory: demand curves and measurement of welfare change
6. Producer theory: production function, short-run and long-run, and return-to-scale
7. Producer theory: profit function, cost curves, and supply function
8. Producer theory: monopoly and oligopoly
9. Market mechanism: social surplus, Pareto efficiency and pure exchange
10. Externalities and countermeasures
11. Measurement of national income and other measurements for nation development
12. Input-Output Analysis of an economy
13. Inflation and foreign exchange rates
14. Foreign aid and foreign direct investment

70030

Project Evaluation for Sustainable Infrastructure

Spring Semester (2-0-0) (Every Year)
Assoc. Prof. Shinya HANAOKA
[Aims]
This course aims to provide the methods necessary to undertake project evaluation and cost benefit analysis for

sustainable infrastructure. The methods comprise of microeconomics background, cost benefit analysis, valuing market and non-market goods, and other technical issues.
[Outline]

1. Introduction to Project Evaluation
2. Basics of Microeconomic Theory
3. Foundations of Cost Benefit Analysis
4. Valuing Benefits and Costs in Primary Markets
5. Valuing Benefits and Costs in Secondary Markets
6. Discounting Benefit and Costs
7. Existence Value
8. Valuing Impacts from Observed Behavior: Direct Estimation Methods
9. Valuing Impacts from Observed Behavior: Indirect Market Methods
10. Contingent Valuation
11. Cost Effectiveness Analysis
12. Accuracy of Cost Benefit Analysis

70044

Coastal Disaster Mitigation

Spring Semester (2-0-0) (Every Year)
Assoc. Prof. Hiroshi TAKAGI
[Aims]
Coastal disasters due to such as tsunamis, storm surges, and high waves lead to considerable loss of human life and property. The threat from coastal disasters may exacerbate because of the impact of climate change and economic development that accelerate rapid population increase in coastal areas. This course comprises lectures on basic theories, engineering, and management for mitigating such risks caused by coastal disasters.
[Outline]

1. Introduction
2. Basic of Water Wave Theory
3. Theory of Astronomical Tides
4. Earthquakes and Tsunamis
5. Tropical Cyclones and Storm Surges
6. High Waves
7. Coastal Erosion
8. Earth's Climate System and Climate Change
9. Structures for Coastal Protection
10. Coastal Management and Ecosystem
11. Case studies
12. Oral Presentation

61084

Advanced Topics in Civil Engineering I

Spring Semester (2-0-0) (Every Year)
Unfixed: Visiting Professor
[Aims and Scope]
The advanced topic is given by a visiting professor.

61055

Advanced Topics in Civil Engineering II

Autumn Semester (2-0-0) (Every Year)

Unfixed: Visiting Professor

[Aims and Scope]

The advanced topic is given by a visiting professor.

70006, 70018

International Development Engineering Field Work A and B

A : Spring Semester (0-0-1) / B : Autumn Semester (0-0-1) (Every Year)

Chair, Department of International Development Engineering

[Aims]

Students shall plan and practice the activities related to the international development engineering. Through the experience of these activities, the students can learn the connection between the course works and the real development.

[Outline]

1. Approval of the working plan by supervisor and department head
2. Activities (more than one week)
3. Submission of the report to supervisor and department head
4. Oral presentation of the report

(Examples of activities)

- Internship or training in foreign or domestic companies.
- Internship or working experience in the organizations related to the international development.
- Field study related to the lectures given in the department.
- Review and survey of state-of-art technologies by participating to an international conference. Visit of other research institution to give presentation or to discuss on research topic, by utilizing this occasion.

61077, 61078

International Internship I, II

I : Spring Semester (0-1-0) / II : Autumn Semester (0-1-0) (Every Year)

Prof. Junichiro NIWA

[Aims and scopes]

Japanese and foreign students who are interested in the mitigation of seismic mega risk in the urban area are strongly recommended to take this course. Enrolled students are required to visit a foreign country to have the experience on the site visit, investigation, and make a report with the students of the counterpart university under the supervision of professors. Finally, enrolled students are required to make the presentation of their report through the collaboration.

61551

70039

Development and Environmental Engineering Off-Campus Project I (CE), (IDE)

Autumn Semester (0-4-0) for Doctor Degree

61552

70040

Development and Environmental Engineering Off-Campus Project II (CE), (IDE)

Spring Semester (0-4-0) for Doctor Degree

[Aims and scope]

Either of above two projects is required for Doctoral degree. The student will take part in an actual project done by an institution or private company. Project period is from three to six months, in which the student should work more than 160 hrs in total. Through this internship projects the student will experience the actual practice in her/his own field and have proper prospects of her/his future profession.

61705
61707
70705
70707
Seminar in Development and Environmental Engineering I, III (CE), (IDE)
Autumn Semester (0-2-0) for Master Degree
[Aims and scope]
Colloquium on topics relating to each course by means of reading research papers and books, and discussion with each supervisor and course coordinator.

61706
61708
70706
70708
Seminar in Development and Environmental Engineering II, IV (CE), (IDE)
Spring Semester (0-2-0) for Master Degree
[Aims and scope]
Colloquium on topics relating to each course by means of reading research papers and books, and discussion with each supervisor and course coordinator.

61851
61853
61855
70851
70853
70855
Seminar in Development and Environmental Engineering V, VII, IX (CE), (IDE)
Autumn Semester (0-2-0) for Doctor Degree
[Aims and scope]
All are offered for Master degree holders. Advanced and high level researches including colloquium, practice and experiment are required.

61852
61854
61856
70852
70854
70856
Seminar in Development and Environmental Engineering VI, VIII, X(CE), (IDE)
Spring Semester (0-2-0) for Doctor Degree
[Aims and scope]

All are offered for Master degree holders. Advanced and high level researches including colloquium, practice and experiment are required.

5.2 Nuclear Engineering Course

71062

Basic Nuclear Physics

Autumn Semester (2-0-0) (Odd Years)

Prof. Masayuki IGASHIRA

[Aims]

Lecture on nuclear physics will be given as a basic subject of nuclear engineering.

[Outline]

1. General Properties of Nuclei (Binding Energy, Statistics, Mass Formula, etc)
2. Nuclear Structure (Free Fermi Gas Model, Shell Models, Collective Models)
3. Nuclear Reactions (Formal Theory, Optical Model, Direct Reactions, Compound Nuclear Reactions, Statistical Model)

71090

Nuclear Reactor Physics

Autumn Semester (2-1-0) (Every Year)

Prof. Toru OBARA

[Aims]

The aim of the lecture is to learn the fundamentals of nuclear reactor physics, which are important to understand the principle of nuclear reactors. The lecture includes exercises and discussions to master the calculation and analysis technique in nuclear reactor physics.

[Outline]

1. Nuclear Reactions and Nuclear Cross Sections
2. The Multiplication factor and Nuclear Criticality
3. Neutron Transport and The Diffusion Appoximation
4. The One-Speed Nuclear Diffusion Equation
5. Neutron Diffusion in Nonmultiplying Equation
6. The One-Speed Diffusion Model of a Nuclear Reactor
7. Multigroup Diffusion Theory
8. Neutron Slowing Down in Infinite Medium
9. Resonance Absorption
10. Neutron Slowing Down and Diffusion
11. Heteroginious Effect
12. Nuclear Reactor Kinetics
13. Effect of Fission Products
14. Burnup Calculation, Reactivity Control, Reactivity Feedback

71043

Nuclear Chemistry and Radiation Science

Autumn Semester (2-0-0) (Odd Years)

Prof. Yasuhisa IKEDA, Assoc. Prof. Yoshihisa MATSUMOTO and Assoc. Prof. Takehiko TSUKAHARA

[Aims]

The aim of this lecture is to learn fundamental knowledge on radio-chemistry (nuclear chemistry), radiation science, including radiation-chemistry, and radiation-material interaction. In addition, introductive lectures are given on the topics relating radiation protection and stable isotopes.

[Outline]

1. History of nuclear chemistry
2. Structure and properties of the atomic nucleus
3. Types of radioactive decay and decay law
4. Interaction of radiation (α, β and γ-rays) with matter
5. Measurement of nuclear radiation
6. Mechanism of nuclear fission and nuclear reactors
7. Environmental behavior of radioactive substances
8. Biological effects of radiation
9. Radiation protection and safety
10. Application of radiation technology
11. Stable isotope measurement and isotope effects

71045

Nuclear Energy Systems

Autumn Semester (2-0-0) (Even Years)

Assoc. Prof. Shunji IIO and Assoc. Prof. Minoru TAKAHASHI

[Aims]

An introductory course is given to the nuclear power reactor systems including fission power reactors and fusion reactors. Fundamental principles governing nuclear fission chain reactions and fusion are described in a manner that renders the transition to practical nuclear reactor design methods. Also future nuclear reactor systems are discussed with respect to generation of energy, fuel breeding, incineration of radio-active materials and safety.

[Outline]

1. Principles of Nuclear Reactor Design
2. Light Water Reactor Power Plant
3. Fast Breeder Reactor Plant
4. Fundamentals of Fusion Reactors
5. Fusion Reactor Design

71046

Nuclear Reactor Safety

Spring Semester (2-0-0) (Odd Years)

Prof. Masaki SAITO, Assoc. Prof. Hiroshige KIKURA and Prof. Hiroshi UJITA

[Aims]

This subject aims to introduce safety principles for nuclear power plants.

[Outline]

1. Safety Characteristics of LWR and FBR
2. Safety Culture
3. Nuclear Reactor Accidents
4. Safety Improvements and Advanced Nuclear Reactors

71002

Nuclear Reactor Design and Engineering

Autumn Semester (2-0-0) (Even years)

T.B.D.

[Aims]

The lectures provide a basic principle of nuclear power reactors, advanced theories of nuclear reactor kinetics and thermal hydraulics and their applications, and in-depth understanding of nuclear reactor safety. With the fundamental

knowledge of nuclear reactor physics as prerequisite, the lectures will cover the theory and practices in nuclear reactor core design and safety evaluation.

[Outline]

1. Design target and approaches, review of nuclear and thermal hydraulics principles
2. Core nuclear characteristics and design, fast reactors and thermal reactors
3. Nuclear reactor dynamics including one-point kinetics,
4. Perturbation theory, reactivity feedbacks
5. Thermal-hydraulics design, design limits, hot spot factors for LWRs and LMFBRs
6. Subchannel analysis
7. Structural engineering and design principle
8. LWR plant safety systems and plant dynamics simulation
9. Probabilistic safety analysis - Introduction to risk-informed design approach
10. Nuclear reactor safety target, reactor protection systems, EPZ
11. Integrated primary system reactor - IRIS and safety by design
12. LMFBR design practices of the MONJU plant

71052

Nuclear Materials Science

Autumn Semester (2-0-0) (Even Years)

Prof. Toyohiko YANO

[Aims]

This is the only lecture concerning materials issues, including nuclear fuels and in-core materials, of nuclear fission and fusion reactors. The basis is materials science. The topics including are: manufacturing methods of nuclear fuels, structures of fuels and fuel elements, moderators, control materials, blanket materials, and structural materials. Another emphasis is put on fundamentals of crystallography, radiation damage and irradiation effects of nuclear reactor materials.

[Outline]

1. Components of GCR, LWR, HWR, LMFBR reactors and material selection
2. Crystalline Defects and Radiation Damage of Materials
3. Physical and Chemical Properties of U, UO_2, and PuO_2
4. Fabrication Process of Nuclear Fuels
5. Fission and Fusion Reactor Materials

71083

Reactor Chemistry and Chemical Engineering

Spring Semester (2-0-0) (Even Years)

Prof. Yasuhisa IKEDA, Prof. Kenji TAKESHITA and Assoc. Prof. Takehiko TSUKAHARA

[Aims]

Technologies in nuclear fuel cycle, e.g., fuel fabrication, uranium enrichment, fuel reprocessing, waste management, will be explained.

[Outline]

1. Introduction
2. Uranium chemistry
3. Properties of actinide elements
4. Mining and refining of nuclear fuel materials
5. Nuclear fuel cycle

6. Nuclear fuel reprocessing and partitioning
7. Chemistry of coolant
8. Corrosion in reactors
9. Reactor maintenance
10. Radioactive waste treatment
11. Radioactive waste disposal
12. Application of nuclear energy to chemical industries

71044

Reactor Thermal Hydrodynamics

Autumn Semester (2-0-0) (Odd Years)

Assoc. Prof. Minoru TAKAHASHI and Prof. Hiroyasu MOCHIZUKI (Univ. of Fukui)

[Aims]

The purpose of this lecture is to study the fundamentals of heat generation, cooling, energy transport and energy conversion in various kinds of fission and fusion reactors, and to understand nuclear energy systems.

[Outline]

1. Heat Generation and Its Transport Systems
2. Heat Conduction in Fuel Matrixes
3. Heat Transfer by Fluid Flow
4. Heat Transfer with Phase Change
5. Thermo-Hydraulic Phenomena in a Two-Phase Flow

71063

Accelerators in Applied Research and Technology

Spring Semester (2-0-0) (Odd Years)

Prof. Yoshiyuki OGURI and Assoc. Prof. Noriyosu HAYASHIZAKI

[Aims]

The objective of this course is to present an overview of accelerator-based research and engineering, which is a growing and vibrant scientific area. Principles of operation of charged particle accelerators with different schemes are briefly explained. The lecture on the accelerators is followed by discussion on the application of accelerators in science and technology, ranging from fundamental research to medical use.

[Outline]

1. Ion sources and electron guns
2. Operating principles of charged particle accelerators
3. Optics of particle beams
4. Accelerator-based fundamental research
5. Application of accelerators in industry
6. Medical application of accelerators

71064

Plasma Science

Autumn Semester (2-0-0) (Odd Years)

Assoc. Prof. Hiroshi AKATSUKA, Assoc. Prof. Shunji IIO and Assoc. Prof. Hiroaki TSUTSUI

[Aims]

This subject aims to introduce fundamental physics of plasmas and their applications. This lecture also covers experimental methods to generate plasmas, diagnostics, fundamental equations to describe weakly ionized plasmas,

applications for material processing, and high density plasmas.
[Outline]

1. Fundamental Concepts in Plasmas
2. Plasma Generation
3. Governing Equations of Plasmas
4. Plasma Properties
5. Plasma Applications

71128

Biological Effects and Medical Application of Radiation

Autumn Semester (2-0-0) (Even Years)
Assoc. Prof. Yoshihisa MATSUMOTO
[Aims & Outline]
To learn (1) biological effects of radiation, (2) mechanisms of biological effects in terms of cell and molecular biology and (3) biological basis of radiation use in medical diagnosis therapeutics.

71137

Radiation Physics

Autumn Semester (2-0-0) (Even Year)
Prof. Satoshi CHIBA
[Aims & Outline]
To understand 1) origins of radiations, 2) their physical properties and 3) interactions with matter. Student with learn basics of special theory of relativity and quantum physics as basics of radiation physics.

71700

Experiments for Reactor Physics

Spring Semester (0-0-2) (Every Year)
[Aims]
To obtain basic experimental technique and experience, special experimental work is made at nuclear research facilities outside Tokyo Institute of Technology. These experiments are scheduled during or prior summer vacation for 1 week. Students belonging to the nuclear engineering course are strongly recommended to attend one of the following programs.
[Outline]

1. Nuclear reactor physics experiments at the Kyoto University Reactor.
2. Nuclear reactor physics experiments at other facility.

71092

Introductory Experiments in Nuclear Engineering

Spring Semester (1-0-1) (Every Year)
Prof. Toyohiko YANO, Prof. Yoshiyuki OGURI and Assoc. Prof. Minoru TAKAHASHI
[Aims]
To learn basic knowledge and technology necessary for nuclear engineering through experiments. This course should be taken before more advanced experimental courses such as “Experiments for Reactor Physics”.
[Outline]
This course consists of the following three sub-terms:
1. Nuclear material experiments: Corrosion of fission nuclear structural materials under high temperature and high water pressure. Several kinds of material characterization techniques are introductory experienced.

2. Thermal-hydrodynamics experiments: Thermal-hydraulic behavior in a fuel pin bundle at increasing heat flux is experimentally simulated using a single pin. Basics of heat transfer from fuel to coolant and hydrodynamics of coolant are studied.

3. Radiation detection and measurements: How to measure ionizing radiations, these are invisible by eye, is important not only to study nuclear engineering but also to use them. Using actual α-ray source, γ-ray source and β-ray source, basics of detection and measurement techniques, absorption and shielding of radiation are studied.

A basic lecture for each sub-term is given at first, followed by four-week-experiment for each sub-term.

71129

Specific **Interdisciplinary Subject in Nuclear Engineering A**
Spring Semester (0-2-0) (Every Year)
Prof. Toru OBARA

71130

Specific **Interdisciplinary Subject in Nuclear Engineering B**
Autumn Semester (0-2-0) (Every Year)
Prof. Toru OBARA
[Aims & Outline]
Understandings of nuclear engineering are the key concepts to bring about technology breakthroughs relating to fundamental energy and environmental issues. This exercise/drill course utilizes a self-study approach on the subjects for students seeking to broaden their knowledge on nuclear reactors and to help acquire sufficient problem-solving skills to conduct research on reactor physics for innovative nuclear reactor systems.
Only the ACEEES students can take this course. In order to promote interdisciplinary research on campus, students are required to take/register courses provided by designated other majors/programs rather than their own majors/programs.

71138

Nuclear Engineering Research Skills I
Spring Semester (0-2-0) (Every Year)
Academic Advisor

71139

Nuclear Engineering Research Skills II
Autumn Semester (0-2-0) (Every Year)
Academic Advisor
[Aims & Outline]
In the program, students learn the fundamental research skills in nuclear engineering including, analysis of background of the field, setting of research purpose, method to solve the questions, and the skills to report the results. The international graduate program students in Department of Nuclear Engineering only can get the credits of this class.

71511

Nuclear Engineering Off-Campus Project I
Spring Semester (0-4-0) (Every Year)
Academic Advisor

71512

Nuclear Engineering Off-Campus Project II

Autumn Semester (0-4-0) (Every Year)

Academic Advisor

[Aims & Outline]

Students can participate in Off-Campus Projects. The projects will be provided by out-side organizations of universities, research institutes, industries, administrative agencies etc. The duration of each Off-Campus Project is from 3 months to 6 months (minimum time is 160 hours). The Off-Campus Project I or II depends on the duration time of the project.

71701-70704

Seminar in Nuclear Engineering I - IV

Master's Course: Spring Semester: I, III, Autumn Semester: II, IV (0-1-0) (Every Year)

[Aims & Outline]

Compulsory subject for Master Course students. This program is conducted through reading of selected books and papers and discussions on the topics in the relevant scientific field with advising professors.

71801-71806

Seminar in Nuclear Engineering V- X

Doctoral Course: Spring Semester: V, VII, IX, Autumn Semester: VI, VIII, X (0-2-0) (Every Year)

[Aims & Outline]

This subject is an advanced program for students in Doctoral Course, conducted in the same way as in the colloquium.

5.3 Infrastructure Metallic Materials Course

24002

Applied Diffraction Crystallography in Metals and Alloys

Spring Semester (2-0-0) (Odd Years)

Prof. Yoshio NAKAMURA

[Aims]

Fundamentals of crystallography and structural characterization by diffraction technique are introduced especially to students who study metallurgy.

[Outline]

1. Symmetry description of crystal
2. How to describe structure of crystals
3. Crystal symmetry and physical properties
4. Ordered structure and modulated structure
5. Diffraction from ideal and imperfect crystals
6. X-ray and Electron diffraction techniques for structural analysis and characterization

97017

Crystallography for Microstructural Characterization

Autumn Semester (2-0-0)

Prof. Toshiyuki FUJII

[Aims & Outline]

This class offers methods of determining the crystal structure and characterizing the microstructure of metals. Students will learn about the basic crystallography, stereographic projection, x-ray and electron diffraction, and electron microscopy. Quizzes are given out to the students in every class.

24043

Advanced Metal Physics

Autumn Semester (2-0-0)

Prof. Ji SHI

[Aims & Outline]

This course is designed to introduce first-year graduate students to the fundamentals and recent developments in solid state physics, especially in relation to metals and alloys. Emphasis is placed on the electronic structures of solids and related properties. Starting from introductory quantum mechanics, the course covers following topics: atomic structure, bonds in metallic and nonmetallic solids, band structure and semiconductors, transition metals and ferromagnetism, physics and applications of thin solid films.

96049

Lattice Defects & Mechanical Properties of Materials

Autumn Semester (2-0-0) (Even Years)

Prof. Susumu ONAKA and Prof. Masaharu KATO

[Aims & Outline]

Lattice defects and their role on mechanical properties of solid materials are lectured. Topics such as linear elasticity (stress, strain, Hooke’s law) and dislocation theory are included.

24042

Thermodynamics for Metallurgists

Spring Semester (2-0-0) (Even Years)

Assoc. Prof. Kenichi KAWAMURA

[Aims]

Thermodynamics is a powerful tool for the material processing and design. This lecture provides the understanding of the thermodynamics from the basics to the applications, and extends to the defect chemistry in solid oxide.

[Outline]

1. Introduction
2. Basics of thermodynamics
3. Gibbs energy
4. Phase diagram and rule
5. Activity
6. Chemical reaction
7. Thermodynamic table
8. Measurement for thermodynamic data
9. Crystal defects
10. Solid state ionics
11. Application of solid state ionics I
12. Application of solid state ionics II

24006

Physical Chemistry of Melts

Autumn Semester (2-0-0) (Odd Years)

Prof. Masahiro SUSA and Assoc. Prof. Yoshinao KOBAYASHI

[Aims]

This lecture mainly centers upon thermodynamics of metal, its oxide melts and metal production process. The term of ‘melts’ essentially means what the term of ‘liquid’ does and is often used, in particular, when one refers to the state of substances which are melted at high temperatures. In this usage, for example, liquid iron is a kind of melt but liquid water is not. Many metallic materials are produced via the state of melts and thus understanding of physico-chemical properties of melts is essential to metallic materials process designing and its optimization. This lecture ranges from fundamental to applied thermodynamics relevant to metals. The final goal is to learn how to use the concept of activity and how to utilize thermodynamic laws and functions, through many exercises. Moreover, this lecture consequently aims to understand the thermodynamic treatment on the practical production process.

[Outline]

1. Basic Thermodynamics
   First law, Internal energy and enthalpy, Second law, Entropy, Third law, Gibbs energy and chemical potential, Chemical equilibria and phase rule, Ellingham diagram
2. Activity
   Law of mass action and concept of activity, Raoultian and Henrian standard activities, Henrian activities by mole fraction and mass% expressions, Interaction parameters, Basicity
3. Solution theory, interaction parameter, solubility product, the Gibbs-Duhem equation, impurities capacity

24055

Transport Phenomena of Metals and Alloys

Autumn Semester (2-0-0) (Even Years)

Assoc. Prof. Miyuki HAYASHI

[Aims]

The lecture focuses on the basic transport phenomena such as flow pattern of liquid, mass and heat transport in liquid and solid and reaction rate at the interface between different phases, which can be seen in the metal smelting, the production process of electrical materials and so on.

[Outline]

1. Introduction
2. Mass transport
    1) Fick's law of diffusion
    2) Shell mass balances and boundary conditions
    3) Steady-state diffusion
    4) Nonsteady-state diffusion
3. Momentum transport
    1) Newton's law of viscosity
    2) Navier-Stokes equation
    3) Laminar flow and turbulent flow
    4) Friction factors
4. Energy transport
    1) Fourier's law of heat conduction
    2) Shell energy balances and boundary conditions
5. Dimensional analysis
    1) Buckingham's pi theorem
    2) Dimensionless numbers for forced convection and free convection
    3) Dimensionless number for heat conduction
6. Macroscopic balances
    1) Isothermal systems
    2) Nonisothermal systems
    3) Bernoulli equation

24008

Phase Transformations in Solids

Autumn Semester (2-0-0) (Even Years)

Prof. Masao TAKEYAMA

[Aims]

Physical and mechanical properties of metals and alloys are directly associated with their microstructures, so it is very important to understand how to control the microstructures through phase transformations. This course of lectures covers the fundamental mechanisms of solid/solid phase transformations and microstructure evolution in ferrous and other materials.

[Outline]

1. Introduction -Basics for studying phase transformations-
    1-1 Thermodynamics and Phase diagrams
    1-2 Diffusion
    1-3 Diffusional Transformations in solids
    1-4 Diffusionless Transformations in solids
2. Microstructures and Phase transformations in Ferrous Materials
    2-1 Phase transformations in iron
    2-2 Pearlite

2-3 Bainite
2-4 Martensite
3. Microstructures of Other alloys
3-1 Titanium and titanium alloys
3-2 Nickel base alloys
4. Phase transformations in Intermetallics
4-1 Order/disorder transformations
4-2 Ordering and Phase Separation

24010

Microstructures of Metals and Alloys

Autumn Semester (2-0-0) (Odd Years)

Prof. Tatsuo SATO

[Aims & Outline]

Characteristics and formation mechanisms of various microstructures of metals and alloys produced during fabrication processes such as cast/solidification, plastic deformation and heat treatments are comprehensively introduced. The fundamental correlation between microstructures and mechanical properties is discussed. The topics on the advanced materials are also introduced.

96048

Characteristics and Applications of Intermetallic Alloys

Spring Semester (2-0-0) (Even Years)

Assoc. Prof. Yoshisato KIMURA

[Aims & Outline]

Intermetallic compounds provide very different physical and chemical properties due to a wide variety of their ordered crystal structures. Starting from fundamental characteristics of intermetallic compounds strongly depending on their ordered structures, advanced applications both for structural and functional are covered with considering strategies for the material design.

97036

Phase Diagram and Related Thermodynamics

Spring Semester (2-0-0) (Even Years)

Prof. Hideki Hosoda and Assoc. Prof. Tomonari Inamura

[Aims & Outline]

The phase diagrams are the key and the map for seeking and creating new metal-base materials. This lecture provides comprehensive understanding of alloy phase diagram in the binary and ternary systems through studying the phase reaction, phase rule, Gibbs free energy and related topics. Practice is provided in each class to develop understanding.

96047

Science and Engineering of Solidification

Spring Semester (2-0-0) (Even Years)

Prof. Shinji KUMAI

[Aims & Outline]

The present lecture provides a fundamental knowledge of solidification, from the scientific to the engineering point of view, covering the recent development and future prospects. Basic concepts of driving force for solidification, undercooling, local equilibrium, and interface non-equilibrium are described. A detailed explanation is also made

about dendritic and eutectic growth, as well as of peritectic, monotectic and behavior of third phase.

96055

Advanced Course in Design and Fabrication of Micro/Nano Materials

Autumn Semester (2-0-0) (Odd Years)

Assoc. Prof. Masato SONE

[Aims]

Fundamentals of design and fabrication of micro/nano materials are introduced especially to students who study materials chemistry.

[Outline]

1. Principle & classification of micro/nano materials
2. Fabrication method, properties and applications of nano particle
3. Fabrication method, properties and applications of nano tube
4. Designs & Fabrication method of molecular machine
5. Bottom up method of nanotechnology
6. Top down method of nanotechnology
7. Problems of nanotechnology into industry

96050

Diffusion in Alloys

Autumn Semester (2-0-0) (Even Years)

Prof. Masanori KAJIHARA

[Aims]

Evolution of microstructure occurs in many alloy systems at elevated temperatures. Such a phenomenon is usually controlled by diffusion. On the basis of Fick's first and second laws, diffusion can be described mathematically. In the present lecture, various mathematical methods describing diffusion will be explained in detail.

[Outline]

1. Introduction
2. Fick's first law
3. Fick's second law
4. Analytical solution of diffusion equation
5. Application of analytical solution to various problems
6. Boltzmann-Matano analysis
7. Darken's analysis
8. Migration of interface

19066

Environmental Degradation of Materials

Autumn Semester (2-0-0)(Odd Years)

Prof. Atsushi NISHIKATA and Assoc. Prof. Eiji TADA

[Aims]

Based on electrochemistry and surface chemistry, the class offers analytical methods to be applied for degradation mechanisms and its prevention of infrastructural and functional materials in various environments.

[Outline]

1. Electrochemistry of Corrosion
   1.1 Basics of electrochemistry, Electrochemical equilibrium, Standard electrode potential, Potential-pH

diagram
1.2 Kinetics of electrochemistry, Butler-Volmer equation, Exchange current density, Overpotential
1.3 Mixed potential theory, Corrosion potential, Corrosion current, Polarization curve
1.4 Anodic dissolution mechanism: Anodic dissolution of metals and alloys

2. Practical Corrosion and Degradation of Materials
   2.1 Forms of corrosion, Classification of corrosion, Evaluation methods
   2.2 Determination of corrosion, Measurement of corrosion rate
   2.3 Passivity and passive films, Characteristics of passive films
   2.4 Degradation of stainless steel, Localized corrosion, Pitting and crevice corrosion
   2.5 Stress corrosion cracking (SCC), Environmental brittlement (HE, CF)
3. Environmental Degradation of Materials
   3.1 Novel corrosion resistant materials
   3.2 Degradation of electronic devices and materials
   3.3 Degradation of infrastructure and its evaluation
   3.4 Novel methods for evaluation and measurement of materials degradation

24045

Advanced Metallurgical Engineering Laboratory

Autumn Semester (0-0-4)

[Aims & Outline]

The present lecture provides a chance to understand the physical, chemical and mechanical properties of metallic materials through the basic experiments, which include age hardening of aluminum alloys. Heat treatment of ferrous alloys, tensile properties, corrosion behavior, steel making, and so on.

24521, 24522

Materials Off-Campus Project I, II

Spring and Autumn Semesters (0-0-4)

[Aims & Outline]

This course is designed to experience the research and/or production in the material companies. The knowledge of metallurgy studied in Tokyo Tech is expected to utilize in the companies during this internship program.

24701-24704

Seminar in Materials Science and Technology I-IV

Spring and Autumn Semesters (0-1-0)

24801-24806

Seminar in Materials Science and Technology V-X

Spring and Autumn Semesters (0-2-0)

[Aims and scope]

Colloquium on topics relating to each specialty by means of reading research papers and books, and Discussion with each supervisor and course coordinator

24705-24708

Materials Research Methodology I - IV

Spring and Autumn Semesters (0-1-0)

[Aim & Outline]

These lectures aim to give students research methodology on materials science and engineering. Through Parts I and II students will understand the background and objectives of their master thesis researches mainly based upon industrial and scientific trends and will be able to explain them logically. Through Parts III and IV students will achieve competency for oral presentation and thesis-writing.

5.4 Mechanical and Production Engineering Course

40100

Advanced Course of Fluid Power Robotics

Autumn Semester (1-0-0) (Every Year)

Assoc. Prof. Hideyuki TSUKAGOSHI

[Aims]

This course will introduce the basic characteristics and advantages of fluid powered actuators and control systems from the point of applying them to search & rescue robots and medical & welfare robots.

[Outline]

1. Expansion characteristics of the fluid power and its application to jumping behavior
2. Design of the robot using high energy density characteristics of the fluid power
3. Tube actuator and its application to the wearable robot
4. Method of simplifying the valve
5. Epoch making Power Source
6. Functional Fluid

40182

Thermal Radiation Transfer Engineering in Environment

Spring Semester (2-0-0) (Every Year)

Prof. Katsunori HANAMURA

[Aims]

This course provides fundamentals of emission, reflection and transmission of thermal radiation (electromagnetic wave) and the treatment of Radiation Transfer Equation (RTE), and also provides basic theories of near-field radiation and application into energy conversion.

[Outline]

1. Maxwell's electromagnetic wave equations
2. Radiation properties of dielectric and metal materials
3. Emission of radiation (EM wave theory)
4. Fundamentals of quantum theory
5. Radiation transfer equation
6. Lattice vibrations for optic and acoustic waves
7. Spectral control of emission of radiation
8. Near-field radiation
9. Surface Plasmon Polariton
10. Resonance of surface wave
11. Measurement of near-field radiation
12. Radiation transfer and energy conversion
13. Simulation of electromagnetic wave
14. Simulation of spectral control of near-field radiation
15. Energy issues for sustainable community

40067

Advanced Course of Mechanical Vibration

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Motomu NAKASHIMA, Prof. Masaaki OKUMA, Prof. Hiroshi YAMAURA

[Aims]
The course aims to teach basic concepts and recent developments related to mechanical vibrations, structural dynamics, acoustics and vibration control.
[Outline]
1. Vibration of Single-DOF vibration system
   1.1 I mportance of mechanical vibration
   1.2 Undamped single-DOF vibration system
   1.3 Damped single-DOF vibration system
   1.4 Theoretical and experimental modeling into single-DOF vibration system
   1.5 Fundamental of vibration suppression techniques
2. Vibration of multi-DOF vibration system
   2.1 Modal analysis of two-DOF vibration system
   2.2 Forced vibration analysis of Dynamic absorber
   2.3 Dynamic absorber
   2.4 Modal analysis of multi-DOF system
3. Recent topics of mechanical vibration

40032

Advanced Course on Energy Physics

Spring Semester (2-0-0) (Every Year)
Assoc. Prof. Kazuyoshi FUSHINOBU
[Aims]
To provide fundamental concepts of statistical thermodynamics to the graduate students of Mechanical Engineering major. Major focus of the lecture is on the energy transport and conversion phenomena that appear in advanced energy, thermal design/management, and manufacturing applications.
[Outline]
1. Basics of thermodynamics, Kinetics of dilute gases
2. Basic ideas of statistical thermodynamics, Macroscale properties, Maxwell-Boltzmann distribution
3. Bose-Einstein, Fermi-Dirac distribution
4. Ideal gas statistics
5. Dense gas, Intermolecular forces
6. Solid statistics, Liquid statistics, Transport properties
7. Boltzmann transport equation
8. Fuel cell and thermodynamics

40082

Intensive Thermal Engineering

Autumn Semester (2-0-0) (Every Year)
Prof. Ken OKAZAKI, Prof. Tomohiro NOZAKI, Assoc. Prof. Seiji OKAWA, Assoc. Prof. Yoichi MURAKAMI
[Aims]
The aim of this subject is to extend the students' understanding of the essential part of thermal engineering, comprehensively. The classes are given by two or three lecturers according to their specialty. Opportunity to do exercise will be provided frequently for better understanding.
[Outline]
1. The first law of thermodynamics, The second law of thermodynamics, Ideal gas, Carnot cycle
2. Available energy (Exergy)

3. Gas power cycles (Otto cycle, Diesel cycle, Gas turbine, etc.)
4. Vapor power cycles (Rankin cycle, Heat pump)
5. Basic concepts of heat transfer; Thermophysical properties
6. Heat conduction
7. Principle of convection heat transfer; Forced convection
8. Natural convection; Heat exchangers
9. Boiling
10. Condensation
11. Radiation
12. Numerical heat transfer

40042

Thermal Engineering in Environmental Problems

Autumn Semester (1-0-0) (Every Year)

Prof. Shuichiro HIRAI

[Aims]

This course introduces energy and environmental problems in modern civilization based on enormous consumption of fossil fuel. Emphasis is placed on thermal engineering and fluid dynamical aspects of efficient utilization of energy and advanced energy conversion system with electrochemical reaction.

[Outline]

-Introduction of various energy systems in environmental problems
-Greenhouse gas control technologies including CO2 capture and storage
-Efficient utilization of energy and advanced energy conversion technologies
-Resources, technologies, and their status
-Electrochemical systems for energy conversion

40147

Advanced Course on Basic Phenomenon of Liquid/Solid Phase Change

Spring Semester (1-0-0) (Every Year)

Assoc. Prof. Seiji OKAWA

[Aim]

Transferring phenomenon of thermal energy related to phase change between liquid and solid is presented, macroscopically and microscopically. The main points are extracted and explained clearly to help understanding the overview. Various methods of numerical analysis to solve heat transfer phenomena are explained, briefly. Applications in engineering field related to transferring phenomenon of thermal energy as liquid/ solid phase change is also introduced.

[Outline]

Homogeneous and heterogeneous nucleation
Numerical analysis for heat transfer problem including melting & solidification
Fundamentals of Molecular Dynamics Method
Methods to control freezing of supercooled liquid
Melting and solidification of ice and water using Molecular Dynamics Method
Measuring method of thermal properties
Permeability and porosity of ice particles as porous media

40181

Physical Chemistry of Solution and Mixture

Autumn Semester (1-0-0) (Every Year)

Prof. Takayoshi INOUE

40044

Advanced Course of Measurement Systems

Autumn Semester (1-0-0) (Every Year)

Assoc. Prof. Shinji OHYAMA

To realize advanced measurement systems, methodologies will be discussed from viewpoints of measurement principles, sensors, signal processing and system configuration including both software and hardware. Sensor networks will be also explained.

40086

Advanced Course of Mechanics of Materials

Autumn Semester (1-0-0) (Every Year)

Prof. Kikuo KISHIMOTO

[Aims]

This lecture aims to teach basic concepts of the mechanics of solids, emphasizing on mathematical modeling and energy concept.

[Outline]

-Fundamental equation of continuum solids
-Thermodynamics of solids
-Energy principle
-Inelastic behavior and plasticity
-Damage Mechanics
-Crack Mechanics

40150

Advanced course of Mechanics of Fatigue and Fracture of Materials

Spring Semester (1-0-0) (Every Year)

Prof. Haruo NAKAMURA

[Aims]

This course will introduce the mechanics of fatigue, including low and high cycle fatigues, their influencing factors and initiation and growth mechanisms. Also taught are the fracture problems, including the fracture toughness and the fatigue crack growth based on the fracture mechanics.

[Outline]

- General Explanation of 'Strength of Materials'
- High cycle fatigue
- Influencing factors
- Low cycle fatigue
- Initiation and growth mechanisms
- Elementary fracture mechanics
- Fatigue crack growth

40146

Linear Fracture Mechanics

Autumn Semester (1-0-0) (Every Year)

Prof. Akira TODOROKI, Assoc. Prof. Yoshihiro MIZUTANI

[Aims]

The present course provides basic understanding of fracture of mechanical engineering structures. The course deals with the basic mechanics of materials from the definitions of stress and strain in the first lecture, and it includes outline of the linear fracture mechanics under the small scale yielding condition. The linear fracture mechanics is indispensable for mechanical engineers to prevent failures due to crack growth. Applicants should have attended the Advanced Course of Mechanics of Materials.

[Outline]

1. Mechanics of Material and Fracture
2. Theory of elasticity & Stress Intensity factor
3. Crack Tip Plasticity
4. Fracture toughness and Fracture toughness test
5. Fatigue & Stress Corrosion Cracking
6. Structural integrity evaluation process for a nuclear power plant & Non Destructive Testing
7. Examination

40019, 40020, 40021, 40022

Special Lecture on Strength of Materials A, B, C, D

(1-0-0)

A: Spring Semester, Even Years, Prof. Kikuo KISHIMOTO, Assoc. Prof. Kazuaki INABA

B: Autumn Semester, Even Years, Prof. Haruo NAKAMURA

C: Autumn Semester, Odd Years, Prof. Antolio GALLEGO MOLINA, Assoc. Prof. Yoshihiro MIZUTANI

D: Autumn Semester, Odd, Years, Prof. Hirotsugu INOUE, Assoc. Prof. Motoki SAKAGUCHI

[Aims]

The aim of this course is to provide advanced and up-to-date topics in mechanics of materials. Each lecture is given by distinguished researcher in some specific field of mechanics of materials from all over the world. The main target of the course is students who are making researches in the field of mechanics of materials.

[Outline]

Subjects are selected form current research topics of strength of materials

40174

Creative Design for Innovation

Autumn Semester (1-1-0) (Every Year)

Assoc. Prof. Celine MOUGENOT

[Aims]

This class covers design theory and design methods for innovation, based on industrial design and user-centered product design approach. The students will conduct a design project in groups: generating ideas of creative concepts of technological products and making prototypes and products.

[Outline]

1. Introduction to design an innovation
2. Trends in technological innovative design: Wearable tech, quantified self, tangible interfaces, emotional design, smart things and connected objects

3. Ethnography and user research
4. Crazy Design Workshop (ideas generation)
5. Idea development (sketching, storyboarding, prototyping)
6. Making (fabrication)
7. Making and user testing

40031

Intelligent Control

Spring Semester (1-0-0)

Assoc. Prof. Daisuke KURABAYASHI

[Aims]

This lecture aims to teach fundamentals of intelligent control techniques including artificial neural networks, fuzzy control and some soft-computing techniques. This lecture also covers machine learning and searching methods.

[Outline]

1. Static and Adaptive systems: High gain system and gain scheduled method.
2. Non-minimal realization and Adaptive Identifiers
3. Model Referenced Adaptive Control System
4. Stochastic systems and Self-tuning Regulator
5. Fuzzy theory and control
6. Artificial Neural Networks
7. Reinforcement Learning

40180

Human Brain Functions and Their Measurements

Spring Semester (2-0-0) (Every Year)

Assoc. Prof. Takako YOSHIDA

[Aims]

Robust, qualitative, psychophysical assessment on the relationship between the physical environment and the user's subjective experience is one of the core skills to optimize the machine usability, design, interface, etc. This course focuses on the latest brain science topics related to it and show some of the methods and limitations to assess the human internal process for the engineering.

[Outline]

Human sensory systems
Color vision and color technology
Motion perception and 3D vision
Eye movement, visual attention, and usability test
Face recognition, biological motion, motion capture techniques, and robot design
Active and passive touch
Body action, affordance, and ecological approach
Crossmodal perception and its digital applications
Short, long, and working memory
Verbal comprehension
Human self-body perception, tool usage, and man-machine interface
Evolution and cognitive brain development
Social brain and theory of mind as a ghost in the machine
Psychophysical methods

Sensors and methods to assess the human brain functions

40162

Manufacturing Engineering and Technology I

Spring Semester (1-0-0) (Odd Year)

Prof. Masahiko YOSHINO

[Aims]

In order to understand various phenomena in mechanical manufacturing processes, it is important to study mechanical behavior of work-material, and to clarify effects of various factors such as friction on the processing property. In this course, plasticity theory is lectured to describe the fundamental mechanical behavior of materials. Also, analytical models of various manufacturing processes based on the plasticity theory are explained. Up-setting, extrusion, drawing, rolling process are employed as examples of the analytical models, and their characteristics are discussed.

[Outline]

1. Introduction
2. Stress and strain
3. Principles of plasticity theory
4. Up-setting
5. Extrusion and drawing
6. Rolling

40170

Manufactuering Engineering and Technology II

Spring Semester (1-0-0) (Even Year)

Assoc. Prof. Takatoki YAMAMOTO

40015, 40016, 40017, 40018

Special Lecture on Mechano-Infra Engineering A, B, C, D

A: Spring Semester (1-0-0) (Every Year)

B: Spring Semester (1-0-0) (Every Year)

C: Autumn Semester (1-0-0) (Every Year)

D: Autumn Semester (1-0-0) (Every Year)

[Aims]

Interdisciplinary subjects for mechanical and production engineering in order to master the ability of creative research and development regarding to the production project

[Outline]

1. Basic understanding of Mechano-Infra Engineering
2. Concept of mechanical and production engineering
3. Research and development in practical field
4. Internship with Laboratory and Company

40138

Automotive Structural System Engineering (TAIST)

Autumn Semester (3-0-0)

Prof. Hiroshi YAMAURA, Prof. Hiroaki MORIMURA, Assoc. Prof. Kazuaki INABA

[Aims]

Vehicle research and development are overviewed, including planning and design, process from advanced research to the future prospect. Suspension and driven-train systems are presented structural mechanics for automobiles.
[Outline]

1. Overview on Vehicle Research and Development (15 hours, H. Yamaura)
   - 1.1 Vehicle Planning and Design
     - (1) From Advanced Research to Marketing
     - (2) The Past and the Future Prospect
   - 1.2 Vehicle Components
     - (1) Propulsion, Engine
     - (2) Body and Suspension
   - 1.3 Vehicle Characteristics
     - (1) Performance of Man-Machine-Environment System
     - (2) Active Safety and Passive Safety
2. Suspension and Drive-train Systems (15 hours, H. Morimura)
   - 2.1 Suspension system
   - 2.2 Steering System
   - 2.3 Tire and its interaction with road surface
   - 2.4 Braking System
   - 2.5 Friction and tribology
   - 2.6 Drive-train
   - 2.7 Stability and maneuverability analysis
   - 2.8 Advanced Control System
3. Structural Mechanics for Automobiles (15 hours, K. Inaba)
   - 3.1 Automobile body
   - 3.2 Body structural requirements
   - 3.3 Automotive body structural elements
   - 3.4 Design for body bending
   - 3.5 Design for body torsion
   - 3.6 Design for crashworthiness

40139

Automotive Comfort Mechanics Engineering (TAIST)

Autumn Semester (3-0-0)

Assoc. Prof. Masaki YAMAKITA, Prof. Katsunori HANAMURA, Prof. Masaki OKUMA

[Aims]

Automotive comfort mechanics engineering is introduced through electronic control engineering, aerodynamics, air-conditioning and vibration noise engineering.

[Outline]

1. Electronics and Control Engineering (15 hours, M. Yamakita)
   - 1.1 Introduction of electronics and control in automobiles
   - 1.2 Electric control of engines and transmission
   - 1.3 Electronics in operation monitoring
   - 1.4 Electric control in braking systems
   - 1.5 Electric control systems for automotive mobility and safety
2. Aerodynamics and Air Conditioning (15 hours, K. Hanamura)
   - 2.1 Fundamentals of Fluid-Dynamics

2.2 Computational Fluid Dynamics (CFD)
2.3 Aerodynamics in Vehicles
2.4 Thermodynamics in Air-Conditioners
2.5 Air-Conditioning Systems in Vehicles

3. Vibration and Noise Engineering (15 hours, M. Okuma)
   3.1 Introduction of automotive vibration and noise problems
   3.2 Measurement and data processing for vibration and noise
   3.3 Modelling for vibration and noise analysis, and comfortability
   3.4 Numerical simulation of vibration and noise
   3.5 Structural design and technology for vibration and noise reduction

40140

Advanced Production Engineering (TAIST)

Autumn (Summer) Semester (3-0-0)

Prof. Masahiko YOSHINO, Assoc. Kunio TAKAHASHI, Assoc. Prof. Sadami SUZUKI

[Aims]

Fundamentals of production engineering are introduced through advanced production processes for integrated and intelligent manufacturing system, advanced welding technologies and quality management.

[Outline]

1. Metal Foaming for Automotive Production (15 hours, M. Yoshino)
   1.1 Fundamentals of Metal Foaming
   1.2 Mathematical Analysis of Forging
   1.3 Mathematical Analysis of Drawing/Extrusion
   1.4 Mathematical Analysis of Rolling
   1.5 Recent Topics of Metal Forming Technology
2. Welding and Joining (15 hours, K. Takahashi)
   2.1 Physics and Basic Engineering in Welding and Joining
   2.2 Welding and Joining processes
   2.3 Equipments for Welding and Joining
   2.4 Behaviour of Materials in Welding and Joining
   2.5 Design and Construction of Joints
   2.6 Analyses of Joints
   2.7 Examples of Welding and Joining process
3. Quality and Operations Management (15 hours, S.Suzuki)
   3.1 Quality Management
   3.2 Inventory Managemen
   3.3 Production Management
   3.3 Project Management
   3.4 Theory of Constraints
   3.5 Supply Chain Management

40141

Combustion Engineering (TAIST)

Autumn Semester (3-0-0) (not open)

Prof. Shuichiro HIRAI, Prof. Hidenori KOSAKA

[Aims]

Fundamentals of combustion are presented through reactive gas dynamics and combustion technologies in internal combustion engines.

[Outline]

1. Fundamentals of Combustion (15 hours, S. Hirai)
   1.1 Reactive gas dynamics (laminar and turbulent flames)
   1.2 Ignition and extinction
   1.3 Reaction kinetics and simulation
2. Thermodynamics in Internal Combustion Engines (15 hours, H. Kosaka)
   2.1 First and second laws of thermodynamics in internal combustion engines
   2.2 Gas cycles of internal combustion engines
   2.3 Thermodynamic analysis of heat release rate in internal combustion engines
3. Combustion Technologies in Internal Combustion Engines (15 hours, H. Kosaka)
   3.1 Combustion in spark ignition engine
   3.2 Combustion in compression ignition engine

40142

Advanced Internal Combustion Engine Engineering and Future Power Train (TAIST)

Autumn Semester (3-0-0)

Prof. Hidenori KOSAKA, Prof. Katsunori HANAMURA, Prof. Shuichiro HIRAI

[Aims]

Flow and combustion diagnostics in IC engines, zero emission technologies and future energy systems for sustainability is presented from the point of views of present status and future prospect.

[Outline]

1. Advanced Combustion Technologies in Internal Combustion Engines (15 hours, H. Kosaka)
   1.1 Advanced technologies for improvement of thermal efficiency of internal combustion engines
   1.2 Advanced technologies for reduction of emissions from internal combustion engines
2. Zero Emission Technologies (15 hours, K. Hanamura)
   2.1 Production and control of NOx
   2.2 Production and control of particulate matters
   2.3 Advanced zero emission technologies
3. Future Power Train for Sustainable Community (15 hours, K. Okazaki)
   3.1 Energy consumption and environmental protection -Present status in South-East Asia and World-
   3.2 Future energy systems for sustainability
   3.3 Present status and future prospect of sustainable mobility
   Battery electrical vehicle, hybrid vehicle, fuel cell vehicle

40143

Basics of Automotive Design (TAIST)

Autumn Semester (3-0-0)

Prof. Hiroaki MORIMURA, Prof. Masaaki OKUMA

[Aims]

Vehicles are designed using a Computer Aided Design (CAD) system, including mesh generation and theory of line and curved surface as well as reverse engineering.

[Outline]

1 Basics of CAD (15 hours, M. Okuma)
   1.1 Overview of CAD

1.2 Theory of Curved Line and Curved Surface
1.3 Theory of Mesh Generation
1.4 Theory of Reverse Engineering

2 Basics of CAE (15 hours, H. Morimura)
2.1 Overview of CAE
2.2 Technology for Analysis
(Finite Element Method, Boundary Element Method, Optimization Analysis, Control Engineering)
2.3 Application examples

3 CAE Model (15 hours, H. Morimura)
3.1 Generating CAE Model from CAD
3.2 Generating CAE Model from Measured DATA
3.3 Generating CAE Model from Experiments
3.4 Identification of CAE Model

40144

Practice of Automotive Design (TAIST)

Autumn Semester (3-0-0) (Open in Thailand)

Prof. Hiroaki MORIMURA

[Aims]

Practice of design of formula car is performed using a concept of frame structures and analysis of strength and stiffness.

[Outline]

1 Practice of Design (1) / Design of SAE-Formula Car (15 hours, H. Morimura)
1.1 Planning of Vehicle
1.2 Harmonization of Performance and Components
1.3 Concept of Frame Structures
1.4 Analysis of Strength and Stiffness with CAD/CAE

2 Practice of Design (2) / Analysis of SAE-Formula Car (15 hours, H. Morimura)
2.1 Tuning of Engine Performance and Gear ratio
2.2 Braking effort and Brake-lock
2.3 Performance of Circling Movements
2.4 Maneuverability

3 Assembly and Disassembly of Engine and Beam Model (15 hours, H. Morimura)
3.1 Disassembly of Engine and Measurement of Components
3.2 Assembly of Engine
3.3 Assembly of Miniature Beam Model for Frame Structure
3.4 Measurement of Beam Model

40165, 40166

System Project Research A, B

(0-2-0)

This course should be taken before “Mechanical and Production Engineering Off-Campus Project I, II” as the planning work for the Off-Campus Project. The details should be consulted with the academic advisor.

40701 - 40704

Seminar in Mechanical and Production Engineering A,B,C,D

A, C: Autumn Semester (0-2-0)

B, D: Spring Semester (0-2-0)

Academic Adviser

These courses are only for IGP-A master course students

40167, 40168

Mechanical and Production Engineering Off-Campus Project I, II

(0-4-0)

This project is required for Doctoral degree. The student will take part in an actual project done by a private company or institution. Project period is from three to six months, in which the student should work more than 160 hrs in total. The student will experience the actual practice in her/his own field and have proper prospects of her/his future profession through this internship projects. Before taking this course, the student should take "System Project Research A or B" for his/her planning work of the project.

46721 - 46724

Seminar in Mechanical Sciences and Engineering I – IV

I, III: Spring Semester (0-2-0)

II, IV: Autumn Semester (0-2-0)

Academic Adviser

These courses are only for IGP-C master course students who belong to Dept. of Mechanical Sciences and Engineering.

46801 - 46806

Seminar in Mechanical Sciences and Engineering V– X

V, VII, IX: Spring Semester (0-2-0)

VI, VIII, X: Autumn Semester (0-2-0)

Academic Adviser

These courses are for IGP-A and IGP-C doctoral course students who belong to Dept. of Mechanical Sciences and Engineering.

47721 - 47724

Seminar in Mechanical and Control Engineering I – IV

I, III: Spring Semester (0-2-0)

II, IV: Autumn Semester (0-2-0)

Academic Adviser

These courses are only for IGP-C master course students who belong to Dept. of Mechanical and Control Engineering.

47801 - 47806

Seminar in Mechanical and Control Engineering V – X

V, VII, IX: Spring Semester (0-2-0)

VI, VIII, X: Autumn Semester (0-2-0)

Academic Adviser

These courses are for IGP-A and IGP-C doctoral course students who belong to Dept. of Mechanical and Control

Engineering.

48721 - 48724

Seminar in Mechanical and Aerospace Engineering I – IV

I, III: Spring Semester (0-2-0)

II, IV: Autumn Semester (0-2-0)

Academic Adviser

These courses are only for IGP-C master course students who belong to Dept. of Mechanical and Aerospace Engineering.

48801 - 48806

Seminar in Mechanical and Aerospace Engineering V – X

V, VII, IX: Spring Semester (0-2-0)

VI, VIII, X: Autumn Semester (0-2-0)

Academic Adviser

These courses are for IGP-A and IGP-C doctoral course students who belong to Dept. of Mechanical and Aerospace Engineering.

5.5 Information and Communication Technology Course

54027

Advanced Electromagnetic Waves (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Makoto ANDO

Assoc. Prof. Jiro HIROKAWA

[Aims]

The objective of this course is to provide the basic methodology and the interpretation in the boundary value problems of electromagnetic waves. Some canonical problems in electromagnetic wave scattering are solved. Important concept of "field equivalence theorem" is explained. The following topics are included.

[Outline]

1. Derivation and interpretation of Maxwell's equations
2. Linear differential equations
3. Boundary, edge and radiation conditions
4. Radiation from a dipole
5. Solutions for homogeneous equations
6. Canonical problems solved by separation of variables
7. Diffraction from a half plane
8. Diffraction from a cylinder
9. Direct integration the field equations
10. Field equivalence theorem

54026

Wireless Communication Engineering (IGP-A ICT)

Spring Semester (2-0-0) (Every Year) (Cancelled since 2014)

(T.B.D.)

[Aims]

The fundamentals in wireless communication engineering, from wireless channel characteristics to traffic control are to be explained.

[Outline]

1. Introduction, Electromagnetic Wave: Information, Energy, Sensing
2. Channel Fading, Channel Estimation, Diversity Technique
3. Noise & Interference, Spatial Signal Processing
4. MIMO Transmission: Spatial Multiplexing
5. UWB Transmission: Low Frequency Efficiency
6. Digital Modulation & Demodulation
7. Filtering, Signal Conditioning and Processing
8. Software Defined Radio & Cognitive Radio
9. Digital RF Circuit Design: Combination of CT and DT Systems
10. Error Correction Codes & Information Theory
11. Multiple Access and Multi-User Communication
12. Power Amplifiers: Nonlinear Distortion, Efficiency, Architecture
13. Cryptography for Secure Networking

54024

MIMO Communication Systems (IGP-A ICT)

Autumn Semester (2-0-0) (Cancelled since 2013)

(T.B.D.)

[Aims]

The lecture focuses on MIMO transmission systems for wireless broadband communications. Basic principles, channel capacity, propagation model, processing schemes, and system structure for MIMO communications are introduced. Fundamentals of wireless communication and array signal processing are also lectured for the basis of MIMO communication systems. Furthermore, future perspective of MIMO systems in wireless LAN and cellular standards are also given.

[Outline]

1. Guidance of the course
2. Major issues in wireless communications
3. Fundamentals of wireless communications
4. Orthogonal frequency division multiplexing
5. Array signal processing
6. MIMO channel capacity
7. Double directional spatial channel model
8. MIMO receiver
9. MIMO transmitter
10. Adaptive MIMO communications
11. Multi-user MIMO
12. Distributed MIMO networks
13. Standardization of MIMO systems

54025

Guided Wave Circuit Theory (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Tetsuya MIZUMOTO

[Aims]

The lecture is focused on the guided wave theory and its application to the design of guided wave circuit in microwave, millimeter-wave and optical frequency regions.

Topics included are electromagnetic wave in waveguides, dispersion in an optical fiber, coupled mode theory, electromagnetic wave in a periodical structure, scattering matrix representation, eigen excitation, and the design of some guided wave circuits.

[Outline]

1. Introduction to guided wave circuits
2. Transmission lines
3. Plane wave propagation
4. Planar waveguides for microwave and millimeter-wave
5. Metallic hollow waveguides
6. Optical planar waveguides
7. Wave propagation in optical fibers (dispersion and nonlinearity)
8. Coupled mode equation
9. Guided waves in periodic structures
10. Circuit representation by a scattering matrix

11. Eigen excitation and eigen values
12. Couplers and dividers
13. Resonators, filters and multi/demultiplexers
14. Nonreciprocal circuits

54029

Plasma Engineering (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Lecturer. Nozomi TAKEUCHI

[Aims]

Plasma technologies play an important role in various industrial applications. The objective of this lecture is to understand the fundamental physics and the engineering side of plasma. Excitation and ionization, behavior of charged particles in electromagnetic field, behavior of plasma as particles and fluid, collision and transportation of particles, plasma generation, measurement techniques, and industrial applications will be lectured.

54030

Advanced Course of Power Electronics (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Assoc. Prof. Hideaki FUJITA

[Aims]

This course presents analysis and control methods of power electronics circuits converting and controlling of electric power by using semiconductor switching devices. It deals with switching transitions in MOSFETs and IGBTs, commutation in voltage-source bridge converters, voltage and current feedback control, applications to grid-connected converters, and so on.

54022

Electric Power and Motor Drive System Analysis (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)

Prof. Hirofumi AKAGI

[Aims]

The aim of this graduate class is to achieve analysis of electric power systems on the basis of the theory of instantaneous active and reactive power in three-phase circuits in comparison with conventional theories. In addition, this class includes applications of the theory to power electronic equipment.

Note that this graduate class is based on the following two undergraduate classes: Power Electronics and Electric Machinery.

[Outline]

1. Analytical methods and basic theories
2. Active and reactive powers in single-phase circuits
3. Instantaneous power theory in three-phase circuits
    1. Definition of the instantaneous active reactive powers and their physical meanings
    2. Applications of the theory to power electronics equipment
4. Coordinate transformation
    1. Absolute transformation and three-to-two phase transformation
    2. dq transformation
5. Voltage and current equation and instantaneous torque of ac machines
6. Vector control of induction machines

7. Vector control of synchronous machines

54031

Magnetic Levitation and Magnetic Suspension (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Akira CHIBA

[Aims]

At the era of the 21 century, magnetic levitation and suspension have been introduced into some practical applications. There are maglevs such as the JR Yamanashi Maglev, the Linimo train in Nagoya, and the Shanghai Maglev. On the other hand, bearingless motor water pumps for pure water, magnetic bearings for turbo molecular pumps are used in semiconductor processes. In this lecture, we will study about super conductor magnetic levitation, Maglev train systems, magnetic bearings, and bearingless motors.

54028

Technology Innovation and Standardization I (IGP-A ICT)

Spring semester (2-0-0) (Every Year)

Prof. Tomoki WATANABE

[Aims]

Occurring in abundance the cases that companies with competent technology do not succeed in business, many people are calling for the importance of standardization and of the business and standardization strategy, highlighting Human Resource Development that presents a significant challenge. This course aims to obtain basic knowledge of the standardization, to learn the rules of discussion and to be accustomed to international discussions.

[Outline]

1. Significance of standardization / Preparation for discussion
2. Methods of standardization / Selection of the item of discussion 1
3. International Standards and the standardization bodies / Proposal presentation
4. How to make international standards / Comment presentations 1
5. Metrological standards / Comment presentations 2
6. WTO agreement and international standards / minutes
7. Influences of standards on economics / wrap-up
8. Standardization strategy of Europe (case of railway) / Selection of the item of discussion 2
9. Railway standard example 1 / Proposal presentation
10. Railway standard example 2 / comment presentations 1
11. Cutting-edge technology and standards / comment presentations 2
12. Business strategy and standards 1 / Modification of the proposal
13. Business strategy and standards 2/ discussion (open class)
14. Business strategy and standards 3 /minutes and wrap-up
15. Supplemental item / Content of the report / final presentation
16. Q & A for the report

54023

Technology Innovation and Standardization II (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)

Prof. Yukitsuna FURUYA

[Aims]

This lecture focuses on standardization strategy as a business process to bring technology innovation into market,

mainly focusing on communication technology area. Also, practical skills in standardization will be obtained through debate exercises.
Although this lecture handles the related topics with “Technology Innovation and Standardization I”, the contents are independent and II can be studied before I.
[Outline] (L): Lecture, (D): Debate, (L,D): Lecture+ Debate

1. (L) Introduction: what is standardization?
2. (L) Industry utilizing standard heavily, mobile communications
3. (L) Historical standardization strategy, Japan, US, EU
4. (L,D) Debate 1, background explanation, grouping into companies: focused on intra company strategy discussion
5. (D) Debate 1: Discussion among companies
6. (L) Actual standardization example, 3GPP
7. (L,D) Debate 2, background explanation, grouping into companies: focus on introducing a new technology into standard
8. (D) Debate 2: Debate among companies
9. (L) Skills required for standardization
10. (L,D) Debate 3, background explanation, grouping into companies:
11. (D) Debate 3: Debate among companies
12. (L) Creation of a forum
13. (L,D) Debate 4, background explanation, grouping into companies :
14. (D) Debate 4: Debate among companies
15. Wrap-up

55022

Introduction to Photovoltaics (IGP-A ICT)

Autumn Semester (2-0-0) (Cancelled since 2014)

(T.B.D.)

[Aims]

This lecture provides descriptions of the basic operating principles and design of solar cells, of the technology used currently to produce cells and the improved technology soon to be in operation, and of considerations of importance in the design of systems utilizing these cells.

[Outline]

1. Sunlight, solar cells and photovoltaics
   Sunlight, solar cell operation and power generation principles, solar cell modules, photovoltaics roadmap
2. Review of semiconductor properties
   Crystal structure, energy bandgap, electrons and holes, doping and Fermi-level, carrier transport
3. Generation, recombination, and the basic equations of device physics
   Absorption of light, recombination processes, basic equations of semiconductor devices
4. pn junction
   Carrier injection, dark characteristics, illuminated characteristics, solar cell output parameters
5. Efficiency limits, losses, and measurement
   Efficiency limits, effect of temperature, efficiency losses, efficiency measurement
6. Standard silicon solar cell technology
   Si wafers to solar cells, solar cells to solar cell modules
7. Improved silicon solar cell technology
   Back surface field, passivation technology, PERL cell

8. Thin film solar cells
   Amorphous Si, nano-silicon, Cu(InGa)Se_2
9. Other device structures
   III-V compound, dye-sensitized cell, organic semiconductor cells

55023

Advanced Electron Devices (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)

Prof. Shunri ODA

[Aims]

On the basis of Electron Devices and Quantum Theory of undergraduate course, this course provides general consideration on integrated electron devices leading to advanced discussion on limitation of silicon microdevices and possibilities of alternative technology.

[Outline]

1. Approaches for high-speed devices
2. Parameters which determine the speed of ICs
3. Heterojunction devices
4. Scaling limit of MOSFETs
5. Interconnections
6. Physics of quantum effects in nanoscale devices
7. Criteria for quantum effects
8. Fabrication technology of quantum nano-structures
9. Single electron transistors
10. Josephson junction and vortex devices
11. Superconducting digital devices
12. Spintronics
13. Quantum computing and architectures

55024

Mixed Signal systems and integrated circuits (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)

Prof. Akira MATSUZAWA

[Aims]

On the basis of Electronic Circuits and Device for under graduate course, this course provides general consideration on mixed signal system and its integrated circuit technology which becomes the most important technology in current electronics. Basic understandings on mixed signal systems, CMOS circuit design, device technology, and LSI design will be covered.

[Outline]

1. Mixed signal systems
2. Successive approximation ADC
3. High speed A/D and D/A converters
4. Sigma delta Modulator and A/D, D/A converters
5. PLL and related systems

55026

Electronic Materials A (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Shigeki NAKAGAWA

[Aims]

Electronic properties of solids are lectured based on quantum mechanics. Beginning with fundamentals of quantum mechanics, perturbation theory is given as an approximate method. These will be applied to electromagnetic radiation and energy band theory. Fundamentals of transportation, scattering and diffraction of waves and particles in solids are mentioned. Superconductivity and its application to devices are also given.

[Outline]

1. Fundamentals of quantum physics (Review)
2. Time independent perturbation theory - non-degenerate and degenerate system -
3. Time dependent perturbation theory
4. Radiation and absorption of photon
5. Fundamental of energy band theory
6. Scattering and diffraction of waves and particles
7. Introduction of superconductivity
8. Basis of superconductivity I
9. Basis of superconductivity II
10. Josephson's junction & SQUID
11. Magnetic ordering phenomena
12. Magnetic anisotropy
13. Magnetic domain and magnetization process
14. Spin-dependent phenomenon and spintronic devices
15. Miscellaneous topics

55025

Electronic Materials B (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Takaaki MANAKA

[Aims]

The objective of this lecture is to understand fundamentals of crystallography (lattice and point group), physical tensors (of electricity, magnetism, elasticity, and optics), lattice vibration, and methodology of crystallographic analysis (X-ray diffraction, electron beam diffraction, etc.). This lecture also focuses on the optical properties of solids within the framework of crystal physics and solid state physics.

[Outline]

1. Crystal structure
2. Reciprocal lattice
3. Wave diffraction from crystals
4. Crystal symmetry and point group
5. X-ray crystal analysis
6. Fundamentals of optics
7. Interaction between light and matter
8. Light propagation in crystals
9. Crystal symmetry and physical properties ~fundamentals of tensors~
10. Nonlinear optical effects 1

11. Nonlinear optical effects 2
12. Spectroscopic techniques and analysis

55027

Electronic Materials D (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Mitsumasa IWAMOTO

[Aims]

Fundamental theories of dielectric and magnetic properties are lectured for the better understanding of the materials which are used in the field of electronics and electrical engineering. After studying how the polarization, dielectric properties, conductivity and spontaneous magnetization appear in the materials of organic and inorganic materials, extended theory for the application of the properties to the future electronic devices are lectured.

[Outline]

<Fundamentals of electronic properties of organic materials>

1. Dielectric theory
2. Conductivity,
3. Electronic functions
4. Photo-electronic properties
5. Non-linear optics, etc.

<Fundamentals of magnetism>

6. Magnetic ordering phenomena
7. Magnetic anisotropy
8. Domain structure
9. Magnetization process
10. Spin-dependent conductivity theory

55028

Thin Film Devices and Their Applications (IGP-A ICT)

Spring Semester(2-0-0) (Every Year)

Prof. Mutsuko HATANO

[Aims]

The objectives of this class are to understand;

(1) The physical principles and operational characteristics of FETs:
MOSFET, TFTs(Thin Film Transistors), advanced power FETs,

(2) Issues and key technologies for the applications: LSIs,information displays,power-control.

By taking this class, students are expected to get familiar with technologies of modern devices and physics based on thin film technologies, and to know the importance of their applications.

[Outline]

1. Semiconductor Physics (Review)
2. MOS FETs and related devices
3. Applications: LSIs
4. Beyond CMOS
5. Thin film transistors (Si)
6. Thin film transistors (Metal-oxide)
7. Thin film transistors (Carbon)
8. Thin film transistors (Organic)

9. Applications for large area electronics: displays & sensors
10. Seminor
11. Power electronicsa and power devices
12. Power devices (SiC)
13. Power devices (GaN, GaO)
14. Power devices (Diamond)
15. Presentation and Discussion

55032

Materials and Processes for Microsystems (IGP-A ICT)

Spring Semester(1-0-0) (Only in 2014)

Prof. William I. Milne, Lecturer. Andrew J. Flewitt

[Aims]

Microsystems (otherwise known as MicroElectroMechanical Systems, MEMS) are mechanical devices that are fabricated on a micrometre scale using techniques more commonly associated with the semiconductor industry for the fabrication of microelectronic devices. They can be classified as either passive devices (e.g. cantilevers, beams) or actuators (e.g. electrostatic drives, thermal expansion actuators) or sensors (e.g. gyroscopes, pressure sensors) and the worldwide market for these devices has expanded greatly in recent years. This course will introduce both the processing methods by which these devices are manufactured and the properties of the materials which are employed, including traditional silicon-based technology and new materials, such as diamond-like carbon, polymers and biological thin films. Case studies will be used with particular reference to one sensing and one actuating application to exemplify how materials and fabrication processes are integrated

56030

Topics on Communication Systems Engineering (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)

Prof. Tomohiko UYEMATSU, Prof. Isao YAMADA, Prof. Kazuhiko FUKAWA and Assoc. Prof. Kenta KASAI

[Aims]

Recent topics on communication systems engineering and their theoretical background will be explained.

[Outline]

1. Bit Error Rate of Digital Communication Systems
2. Introduction to Error Correcting Codes
3. Performance Analysis of Digital Communication Systems Employing Coding
4. Channel Equalization and Identification: Introduction
5. Adaptive Channel Equalization Techniques
6. Blind Channel Identification by Second Order Statistics
   (Quiz for Lectures 4, 5, 6)
7. Image Coding
8. Video Coding
9. Multimedia Communication Technology for the Internet
10. Multipath Mobile Communication Channels
11. Digital Modulation Schemes for Mobile Communications
12. OFDM Mobile Radio Transmission Systems

56031

VLSI Design Methodologies (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)
Prof. Hiroaki KUNIEDA
[Aims]
According to the design flow of Standard Cell Design, the hierarchical design and verification based on standard cell design will be discussed including hardware description language, logic design and layout design and their verifications.
[Outline]

1. VLSI Overview
2. VlSI_Basic I
3. VlSI_Basic II
4. Standard Cell Design_Overview
5. Standard Cell Design_RTL
6. Standard Cell Design_Logic I
7. Standard Cell Design_LogicII
8. Standard Cell Design_Verify
9. Standard Cell Design_Layout
10. Standard Cell Design_Layout Verification
11. FPGA Design
12. System on Chip (SoC) Design

56032

Advanced Signal Processing (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)
Prof. Akinori NISHIHARA
[Aims]
Several important topics on the design and implementation of signal processing algorithms and their theoretical background will be discussed.
[Outline]

1. Overview of Signal Processing
2. Digital Filter Design
3. Finite Wordlength Effects
4. Multirate Systems (Sampling Rate Alteration)
5. Polyphase Representation
6. Filter Banks
7. M-channel Filter Banks
8. Adaptive Filters
9. Gradient Adaptive Algorithm
10. Recursive Adaptive Algorithm
11. DSP Systems
12. Pipeline and Parallel Processing
13. Implementation of DSP Systems

56033

Quantum Information Processing (IGP-A ICT)

Spring Semester (2-0-0) (Every Year)
Assoc. Prof. Ryutaroh MATSUMOTO

[Aims]
Applications of quantum mechanics to communication and computation are explained. Topics will include quantum teleportation, quantum cryptography, and quantum algorithms. Prerequisite is linear algebra only. I will explain mathematics and physics used in the explanation of the above topics.
[Outline]

1. Mathematical model of quantum systems
2. BB84 quantum key distribution protocol
3. Tensor product
4. Quantum teleportation
5. Superdense coding
6. Examination
7. Quantum algorithm for factoring (1)
8. Quantum algorithm for factoring (2)
9. Quantum algorithm for factoring (3)
10. Quantum channel
11. Quantum error correction
12. BB84 protocol with error correction and privacy amplification
13. Security analysis of BB84

56029

VLSI System Design (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)
Assoc. Prof. Tsuyoshi ISSHIKI
[Aims]
This course is designed to cover the underlining theories and technologies which support the systematic design process of current VLSIs
[Outline]

1. Introduction - VLSI design methodology and computer-aided design (CAD) tools
2. Introduction - Hardware description language and hardware behavior model
3. Logic synthesis - Two-level logic minimization
4. Logic synthesis - Multi-level logic minimization
5. Logic synthesis - Area-optimal technology mapping
6. Logic synthesis - Delay-optimal technology mapping
7. Logic synthesis - Fan-out optimization
8. High-level synthesis - Design methodology
9. High-level synthesis - Operation scheduling
10. High-level synthesis - Resource allocation
11. Advanced topics in system-level design issues

56035

Wireless Signal Processing (IGP-A ICT)

Autumn Semester (2-0-0) (Every Year)
Prof. Kazuhiko FUKAWA
[Aims]
A major aim of the lecture is to help students gain a deep understanding of important transmission techniques for wireless digital communications.

[Outline]

1. Introduction and Review of Basic Knowledge
2. Signal Models for Wireless Communications
3. Statistics of Fading Channels
4. Wiener Filters and Least-Mean-Square (LMS) Algorithm
5. Recursive Least-Squares (RLS) Algorithm
6. Kalman Filters
7. Channel Equalization
8. Blind Deconvolution
9. Frequency-Domain Equalization
10. Turbo Principle
11. Diversity Combining and Adaptive Array Antennas
12. Nonlinear Interference Cancellation
13. MIMO Signal Detection
14. Precoding Techniques
15. Final Examination

76056

Advanced Coding Theory (IGP-A ICT)

Spring Semester (2-0-0) (Odd Years)

Assoc. Prof. Haruhiko KANEKO

[Aims]

The objective of this course is to introduce an application of coding theory to digital systems, and to give how to design excellent codes to improve computer system reliability.

[Outline]

1. Introduction to Code Design Theory for Dependable Systems
2. Faults, Errors, and Failures
3. Bit Error Control Codes: Parity-Check Codes, Hamming Codes, and Hsiao Codes
4. Code Design Techniques: Odd-Weight-Column Codes, Rotational Codes, etc
5. Mathematics Necessary to Design Matrix Codes over Extended Field
6. Byte Error Control Codes: Byte Error Correcting and Detecting Codes
7. Bit/Byte Error Control Codes: Byte Error Detecting SEC-DED Codes
8. Error Locating Codes, and Unequal Error Control/Protection Codes
9. Tape Memory Codes: VRC/LRC, ORC, AXP Codes
10. Magnetic Disk Memory Codes: Fire Codes, Reed-Solomon Codes
11. RAID Memory Codes: EVENODD, X-Codes
12. Optical Disk Memory Codes: CIRC, LDC, RSPC
13. On-Chip ECCs for Microprocessors

76057

Speech Information Processing (IGP-A ICT)

Spring Semester (2-0-0) (Odd Years)

Assoc. Prof. Koichi SHINODA

[Aims]

This course aims to discuss various issues related to speech information processing.

[Outline]

1. Principles of speech production
2. Speech analysis techniques
3. Speech coding techniques
4. Acoustic modeling for speech recognition
5. Language modeling for speech recognition
6. Robust speech recognition
7. Speech recognition for resource-deficient languages
8. Speaker recognition
9. Speech synthesis
10. Application of speech processing techniques

70047

Rural Telecommunications (IGP-A ICT)

Autumn Semester (2-0-0)

Prof. Jun-ichi TAKADA and Assoc. Prof. Takahiro AOYAGI

[Aims]

Telecommunications enable the communications instantly between any points in the world. Moreover, it has become common understanding that the telecommunication infrastructure is indispensable for the development of the industry and economy. However, the reality is very severe in the developing world, especially in rural and remote areas. Imbalance of the distribution of telecommunications in the world has been intolerable for the long time. This lecture overviews the historical aspects and the enabling technologies of rural telecommunications, both in the social and the technical aspects.

[Outline]

1. Guidance
2. Historical Aspects - Missing Link -
3. Historical Aspects - Missing Link & 20 years after-
4. Historical Aspects - 20 years after Missing Link -
5. Current Aspects - Radio Frequency Spectrum -
6. Access Infrastructure 1 - Cellular Systems 1 -
7. Access Infrastructure 2 - Cellular Systems 2 -
8. Access Infrastructure 3 - Satellite Systems -
9. Access Infrastructure 4 - Wireless Computer Network -
10. Information Technology and Free and Open Source Software
11. Case Studies
12. Case Presentation

54501

Electrical and Electronic Engineering Off-Campus Project I

Spring Semester (0-4-0) for Doctor Degree

54502

Electrical and Electronic Engineering Off-Campus Project II

Autumn Semester (0-4-0) for Doctor Degree

55501

Physical Electronics Off-Campus Project I

Spring Semester (0-4-0) for Doctor Degree

55502

Physical Electronics Off-Campus Project II

Autumn Semester (0-4-0) for Doctor Degree

56521

Communication and Computer Engineering Off-Campus Project I

Spring Semester (0-4-0) for Doctor Degree

56522

Communication and Computer Engineering Off-Campus Project II

Autumn Semester (0-4-0) for Doctor Degree

[Aims and scope]

Either of above two projects is required for doctoral degree. The student will take part in an actual project done by an institution or private company. Project period is from three to six months, in which the student should work more than 160 hrs in total. Through this internship projects the student will experience the actual practice in her/his own field and have proper prospects of her/his future profession

5.6 Advanced Materials and Chemicals Processing Course

35005

Advanced Separation Operations

Autumn Semester (2-0-0)

Prof. Akira ITO

[Aims]

This course reviews conventional separation processes, distillation, absorption, drying etc., from a view point of process modeling and simulation. All modeling of a separation process consists of equilibrium relation and mass balance for the process. The mathematical model of a separation process will reduce to equation set of non-linear simultaneous equations or differential equations. Tools for solving for these equations on the spread sheet are offered and used for individual separation process calculation.

[Outline]

1. Introduction, Model and simulation in chemical engineering
2. Distillation - Vapor-liquid equilibrium-
3. Distillation -Process models-
4. Extraction
5. Absorption
6. Membrane separation -Microfiltration and ultrafiltration-
7. Membrane separation -Reverse osmosis -
8. Membrane separation -Gas separation-
9. Adsorption
10. Chromatography
11. Humidity conditioning
12. Drying -Diffusion in material-
13. Drying -Drying process-

35031

Transport Phenomena and Operation for Advanced Materials and Chemicals Processing

Spring Semester (2-0-0)

Assoc. Prof. Shiro YOSHIKAWA

[Aims]

Momentum, heat and mass transfer in chemical equipment is one of the most fundamental subjects in chemical engineering field. The methods of the modeling of the transport phenomena including that in chemical reaction field are discussed in the course. In addition, the fundamentals of the numerical analysis are shown.

[Outline]

1. Introduction
2. Basic equations for transport phenomena (I)
3. Basic equations for transport phenomena (II)
4. Transport phenomena in a boundary layer (I)
5. Transport phenomena in a boundary layer (II)
6. Modeling of transport phenomena in chemical reaction field (I)
8. Modeling of transport phenomena in chemical reaction field (II)
9. Numerical simulation of transport phenomena (I)
10. Numerical simulation of transport phenomena (II)
11. Characteristics of Particles
12. Motion of Particles in Fluid and Fluid Flow in a Packed Bed and Fluidized Bed

13. Mechanical Separation and Classification: Sedimentation, Centrifugation and Filtration
14. Mixing Operation

35032

Fine Particle Engineering

Spring Semester (2-0-0)

Prof. Wiwut TANTHAPANICHAKOON and Assoc. Prof. Izumi TANIGUCHI

[Aims]

There is currently considerable commercial and scientific interest in the production of fine particles employing aerosol-based methods. The objective of this course is to provide fundamentals on the behavior of fine particles in gas phase. In addition, some of recent topics on materials processing by using aerosol-based method will be presented. Students have to prepare reading, bring and review the course textbook (Hinds, W. C., "AEROSOL TECHNOLOGY", John Wiley & Sons, New York (1999)) to every class.

[Outline]

1. Introduction
2. Topics of Material Processing Using Aerosol-based Method (I)
3. Topics of Material Processing Using Aerosol-based Method (II)
4. Motion of a Drop or Solid Particle in Gas Phase at $Re_P > 2$
5. Motion, Heat and Mass Transfer of a Group of Drops or Solid Particles in Gas Phase at $Re_p > 2$
6. Motion of Aerosols ($Re_p < 2$)
7. Brownian Motion and Diffusion in Aerosols
8. Condensation and Evaporation Phenomena in Aerosols
9. Introduction to Nanotechnology --> Nanomaterials --> Nanoparticles
10. Nanoparticles in Industrial Applications
11. Basic Properties of Nanoparticles: Size, Shape, Surface Area, Etc.
12. Manufacture of Nanoparticles: Top-down vs. Bottom-up. Examples of Manufacturing Processes
13. Synthesis of Nanoparticles
14. Nanoparticles in Composite Materials
15. Examples of Unit Operations in Fine Particle Collection & Classification: High-performance Air Cyclone

35033

Material Science and Chemical Equipment Design

Autumn Semester (2-0-0)

Prof. Masatoshi KUBOUCHI, Lecturer Shuji HASHIZUME, and Masao NAKAHARA

[Aims]

The class offers the basic knowledge of the designing method of cylindrical chemical equipments and materials strength. In addition, recent topics on materials science and technology will be presented.

[Outline]

1. Basic of materials science
2. Basic of strength of materials
3. Materials for chemical plant
4. Material selection for oil and gas production
5. Design of thin and thick-walled cylindrical vessel for internal pressure
6. Material problem on chemical equipment

7. Corrosion engineering
8. Degradation of materials
9. Life estimation for chemical equipment
10. Other topics on material science and chemical equipment design

35035

Chemical Engineering for Advanced Materials and Chemicals Processing II

Spring Semester (2-0-0)

Prof. Masabumi MASUKO, Prof. Masatoshi KUBOUCHI, Assoc. Prof. Shinichi OOKAWARA and Assoc. Prof. Yusuke SHIMOYAMA

[Aims]

This class covers essentials of transport phenomena, separation operations, material science, and thermodynamics.

[Outline]

1. Introduction

Part I Chemical Thermodynamics

Prof. Masabumi Masuko

Textbook: P. Atkins, et al., "Atkins' Physical Chemistry-8th Ed." Oxford University Press, Oxford (2002) Chapt.7.

Reference book: M. Abbott, et al., "Theory and Problems of Thermodynamics-2nd.Ed." McGrawhill, New York (1989)

2. Thermodynamics of Mixing, Chemical Equilibrium Part I (Reaction Gibbs Energy, Description of Equilibrium)
3. Chemical Equilibrium Part II (Response of Equilibria to Temperature)
4. Examination

Part II Material Science

Prof. Masatoshi Kubouchi

Textbook: William D. Callister, Jr.: "Material Science and Engineering 3rd Edition", John Wiley & Sons, Inc., New York (1994)

5. Atomic Structures and Interatomic Bonding, Structures of Crystalline Solids
6. Phase Diagrams and Phase Transformations
7. Examination

Part III Momentum Transport Phenomena

Assoc. Prof. Shinichi Ookawara

Textbook: R.Byron Bird, et al.: "Transport Phenomena 2nd Edition" Wiley New York (2002)

8. Newton's Law of Viscosity and Mechanism of Momentum Transfer
9. Momentum Balance
10. Navier-Stokes Equation and Energy Balance
11. Examination

Part IV: Mass Transport Phenomena and Mass Transfer Operations

Assoc. Prof. Yusuke SHIMOYAMA

Textbook: R.Byron Bird,et.al: "Transport Phenomena 2nd Edition" Wiley New York (2002)

12. Mechanism of mass transfer
13. Temperature and pressure dependence of mass diffusivity
14. Diffusion in gas and liquid phases
15. Examination

25008

Advanced Course in Functional Soft Materials

Spring Semester (2-0-0)(Even years)

Prof. Yasuyuki TEZUKA

Fundamentals and advanced subjects in functional soft materials will be discussed from the viewpoints of synthetic chemistry and of topological polymer chemistry, in particular.

25022

Advanced Course in Surface Properties of Organic Materials

Spring Semester (2-0-0)

Prof. Takehiko MORI, Prof. Yukio OUCHI , Assoc. Prof. Ken ISHIKAWA, and Assoc. Prof. Hidetoshi MATSUMOTO

[Aims]

For understanding conducting and optical properties of organic materials, fundamental concepts of energy bands, charge transfer, and optics are lectured.

[Outline]

1. Introduction
2. Energy Band of Organic Crystals
3. Organic Conductors and Organic Electronics
4. Optical Properties of Solids
5. Liquid Crystals
6. Surface Properties of Organic Materials
7. Organic Nanomaterials
8. General conclusions

25023

Advanced Course in Organic Materials for Photonics and Biosensing

Autumn Semester (2-0-0)

Prof. Martin VACHA and Assoc. Prof. Yuhei HAYAMIZU

[Aims]

Organic materials are unique due to their molecular structures and organizations compared with inorganic materials. Physics of the soft materials will be presented particularly from the viewpoints of physics in organic molecules and biomaterials. Assoc. Prof. Vacha will talk about “Photophysics and Spectroscopy of Organic Molecules”. Assoc. Prof. Hayamizu will talk about “Self-assembly of Biomaterials and their Uses for Sensing”.

[Outline of Assoc. Prof. Vacha]

1. Quantum mechanics of the molecule-radiation interaction
2. Excited state of organic molecules and excited state relaxations
3. Molecular complexes
4. Intermolecular photophysical processes
5. External field effects
6. Principles of high resolution optical spectroscopy

[Outline of Assoc. Prof. Hayamizu]

1. Introduction of self-assembly
2. Biological self-assembly

3. Interaction between biomolecules and surfaces
4. Sensing platforms: Nanomaterials
5. Electrical and optical interactions at bio-nano interfaces
6. Recent topics in biomolecular self-assembly and sensing

25042

Advanced Course in Organic and Soft Materials Chemistry

Spring Semester (2-0-0) (Odd Years)

Prof. Masa-aki KAKIMOTO, Assoc.Prof. Teruaki HAYAKAWA and Assoc. Prof. Tsuyoshi MICHINOBU

[Aims]

Fundamentals and advanced subjects in organic and soft materials chemistry will be discussed.

[Outline]

1. Introduction
2. Macromolecular and supramolecular chemistry (I)-- basic principles and concepts
3. Macromolecular and supramolecular chemistry (II) -- synthesis
4. Macromolecular and supramolecular chemistry (III) - functions and applications
5. Condensation polymers (I)-- fundamentals
6. Condensation polymers (II) -- synthesis
7. Condensation polymers (III) - functions and applications
8. Functional soft materials (I) - concepts and synthesis
9. Functional soft materials (II) -- applications
10. General conclusions

24050

Advanced Course in Wettability Control of Solid Surface

Spring Semester (2-0-0) (Odd Years)

Prof. Akira NAKAJIMA

[Aims]

Wettability has been a research subject at the border between physics and chemistry, and is an important property of solid surface from both fundamental and practical aspects. This course provides fundamentals on surface wettability control for the understanding of surface phenomena and the designing surface functions of solids. Topics include environmental purification and energy saving by surface functional materials.

[Outline]

1. Introduction
2. Fundamentals of solid surface
3. Surface energy and contact angle (1)
4. Surface energy and contact angle (2)
5. Surface structure and wettability (1)
6. Surface structure and wettability (2)
7. Sliding of liquid droplets (1)
8. Sliding of liquid droplets (2)
9. Dynamic wettability
10. Anti-snow adhesion
11. Materials for wettability control and their coating technology
12. Superhydrophobicity

13. TiO_2 photocatalyst
14. Research proposal presentation (students)

24053

Advanced Course of Nano-Bionics

Spring Semester (2-0-0) (EVEN Years)

Assoc. Prof. Toshiyuki IKOMA

[Aims]

This course provides complex phenomena/theories of material surfaces in biological tissues, based on surface designs and applications for biomedical devices, and advanced technologies of tissue engineering for bone, cartilage, nerve, and cornea, based on the expression of cell function on bioceramics from inorganic and organic interfacial interactions.

[Outline]

1. History of biomedical devices
2. Biomimetic materials
3. Structure of bio-minerals
4. Surface design of biomaterials
5. Interfacial interaction of materials and cells
6. Methodology of drug delivery carriers
7. Preparation and application of nanoparticles
8. Biological reaction of nanoparticles
9. Detection of biomolecules based on materials
10. Microfluidics for diagnostics
11. Materials science for collagen
12. Scaffolds for tissue engineering
13. Application of bioceramics (I): bone and cartilage
14. Application of bioceramics (II): nerve and cornea
15. Toward to application of biomedical devices

35002

Advanced Chemical Reaction Engineering

Spring Semester (2-0-0) (Every year)

Prof. Kazuhisa OHTAGUCHI

[Aims]

This course is intended for Chemical Engineering majors. Pre-request of “Chemical Reaction Engineering-1” undergraduate-course recommended. The objective of this course is to provide a foundation for mathematical modeling the chemical and biochemical systems in terms of linear and nonlinear, ordinary and partial, differential equations. The main topics include: state space analysis; stability of dynamic models, conservation of mass, pollution in rivers; reaction-diffusion model for morphogenesis; cycles and bifurcation; cusp catastrophes, and chaos. Students have to prepare reading, bring and review the course textbook (Rutherford Aris, “MATHEMATICAL MODELLING TECHNIQUES”, Dover Pub. Inc, (1994)) to every class.

[Outline]

1. Introduction
2. Mathematical models for the tracer movement in a packed bed
3. The Taylor diffusion models with laminar flow
4. Models for the stirred tank reactor

5. A mathematical model
6. Comparison of the implications of a model with experience (chaos)
7. The different type of model
8. Formulation of a model
9. The principle of making the equations dimensionless (the stirred tank with a single first-orderirreversible reaction)
10. The phase plane analysis
11. Manipulation of a model into its most responsive form
12. Effective presentation of a model (catastrophe sets)
13. Models for diffusion and reaction in a catalyst pellet

35008

Catalytic Process and Engineering

Spring Semester (2-0-0) (Every year)

Prof.Wiwut TANTHAPANICHAKOON

Textbook: Fundamentals of Industrial Catalytic Processes, C. H. Bartholomew & R. J. Farrouto, Wiley-Interscience, 2nd ed. (2006)

[Aims]

The course introduces the fundamental concepts of catalytic processes and selected examples of its industrial applications.

[Outline]

1. Guidance+General Introduction + Catalysis (I)
2. Catalysis (II)
3. Catalyst Materials, Catalyst Properties (I)
4. Catalyst Properties (II) + The Future
5. Principles and Objectives of Catalyst Characterization; Catalyst Selection; The Future
6. Definitions and Classification of Reactors; Fundamentals of Rector Design
7. Choosing Reactors in the Laboratory and Plant; The Future
8. Petroleum Refining & Processing: Hydrotreating (I)
9. Petroleum Refining & Processing: Hydrotreating (II)
10. Petroleum Refining & Processing: Hydrotreating (III)
11. Enzyme Catalysis (I)
12. Enzyme Catalysis (II)
13. Enzyme Catalysis (III)
14. Presentation of Individual Project Assignments (I)
15. Presentation of Individual Project Assignments (II)

35036

Plasma Chemistry and Plasma Processing

Autumn Semester (2-0-0) (Every year)

Prof. Hidetoshi SEKIGUCHI and Assoc. Prof. Shinsuke MORI

[Aims]

Characteristics of plasma chemistry, various plasma generation methods for chemistry and various applications of plasma technology to chemistry are lectured. Plasma generation methods include thermal equilibrium plasma; arc plasma, RF plasma microwave plasma and et al. and non equilibrium plasma; glow plasma, microwave plasma, DBD plasma, and atmospheric pressure non-equilibrium plasma. Applications of plasma include application of high

temperature heat source, organic and non organic synthesis, decomposition technology of various materials, separation technology et al. Also current topics in this field are given.
[Outline]

1. Introduction
2. Basics of heat transfer in high temperature
3. Basics of thermal plasmas (I)
4. Basics of thermal plasmas (II)
5. Numerical simulation of thermal plasmas
6. Thermal equilibrium
7. Thermal plasma processing -Material synthesis (I)-
8. Thermal plasma processing -Material synthesis (II)-
9. Thermal plasma processing -Separation-
10. Thermal plasma processing -Chemical synthesis-
11. Thermal plasma processing -Wastes treatment-
12. Basics of non-thermal plasma
13. Non-thermal plasma processing

25021

Advanced Course in Physical Properties of Organic Materials

Autumn Semester (2-0-0) (Every year)

Assoc. Prof. Masatoshi SHIOYA, Prof. Takeshi KIKUTANI and Prof. Junko MORIKAWA

[Aims]

Physical properties of organic materials are not determined only by their chemical structures. Various factors such as the morphology, structure of the crystalline and amorphous regions, processing history of the method used to form the product and environmental conditions have significant influences on the physical properties. This course discusses various factors influencing the physical properties of organic materials and fundamentals of the measurement and analysis of the physical properties.

[Outline]

1. Introduction
2. Fundamental theories for thermal properties of organic materials
3. Analysis methods of thermal properties for organic materials
4. Polymer composites
5. Fundamental theories for mechanical properties of organic materials
6. Carbon materials derived from organic materials
7. Structure development in fiber processing
8. Structure development in polymer processing
9. General conclusions

19007

Advanced Course of Organic Materials Design

Spring Semester (2-0-0) (Odd Years)

Prof.Toshiaki OUGIZAWA and Assoc. Prof. Shigeo ASAI

[Aims]

The basic concept for design of functional organic and polymeric materials and methods to characterize their structure and properties will be provided.

[Outline]

1. Introduction
2. Applications of polymer alloys
3. Morphology-properties relationship in polymer alloys
4. Phase behavior of polymer alloys
5. Thermodynamics of polymer alloys
6. Phase separation behavior of polymer alloys
7. Morphology control of polymer alloys
8. Interface of polymer alloys
9. Concept for design of functional organic materials
10. Structure and properties of polymer-filler composites
11. Electrical properties of carbon particle filled polymers
12. Theory of wide-angle X-ray diffraction
13. Structure analysis of polymer by wide-angle X-ray diffraction
14. Theory of small-angle X-ray scattering
15. Structure analysis of polymer by small-angle X-ray scattering

25029

Advanced Course of Polymer Chemistry

Autumn Semester (2-0-0) (Odd Years)

Prof. Toshikazu TAKATA, Prof. Takeshi SERIZAWA, Prof. Hideyuki OTSUKA, and Prof. Takashi ISHIZONE

[Aims]

This lecture mainly describes the fundamentals of polymer syntheses, reactions, and characterizations. In addition, some of recently advanced subjects in the related fields are introduced.

[Outline]

1. Polymer syntheses and reactions -Introduction-
2. Step-growth polymerization
3. Chain polymerization
4. Radical polymerization
5. Cationic polymerization
6. Anionic polymerization
7. Polymer reactions
8. Cross-linking of polymers
9. Biorelated Polymer Chemistry -Introduction-
10. Biomedical Polymer
11. Functional Biopolymer
12. Advanced Polymer Chemistry -Introduction-
13. Helical Polymer
14. Topological Polymer
15. Examination

25044

Specific Interdisciplinary Subjects in Organic and Polymeric Materials A

Spring Semester (0-2-0) (Every Years)

Assoc. Prof. Reiko SAITO

Microstructure design of organic and polymeric materials is a key concept to impart highly functional properties into substrates, and bring about technology breakthroughs relating to fundamental energy and environmental issues. This exercise/drill course utilizes a self-study approach on this subject for students seeking to broaden their knowledge on

organic and polymeric materials and to help acquire sufficient problem-solving skills to conduct research on structural and functional materials in organic and polymeric materials.
[Evaluation]

25045

Specific Interdisciplinary Subjects in Organic and Polymeric Materials B

Autumn Semester (0-2-0) (Every Years)

Assoc. Prof. Reiko SAITO

Microstructure design of organic and polymeric materials is a key concept to impart highly functional properties into substrates, and bring about technology breakthroughs relating to fundamental energy and environmental issues. This exercise/drill course utilizes a self-study approach on this subject for students seeking to broaden their knowledge on organic and polymeric materials and to help acquire sufficient problem-solving skills to conduct research on structural and functional materials in organic and polymeric materials.

35037

Life Cycle Engineering

Autumn Semester (2-0-0) (Every year)

Assoc. Prof. Tetsuo FUCHINO

[Aims]

To realize the sustainability in the chemical industry, activities through the lifecycles; plant lifecycle, product lifecycle, process lifecycle, should be designed to provide PCDA (Plan, Do, Check and Action) cycle properly, and the integrated information environment through the lifecycles is indispensable. In this class, the methodology to model the lifecycle activity is discussed, and on the basis of the model, the lifecycle safety management issue is considered.

[Outline]

1. Introduction (Lifecycle engineering perspective of chemical process industry)
2. Problems in lifecycle, -Case and causality
3. BPR (Business Process Reengineering) approach
4. Lifecycle activities of chemical process industry
5. Modeling lifecycle activities -Necessity and approach
6. Business model methodology: IDEF (Integrated Definition for Functional model) Family overview
7. IDEF0 modeling (Syntax, Template, Ontology)
8. IDEF0 modeling (Ontology)
9. IDEF0 modeling practice (I)
10. IDEF0 modeling practice (II)
11. IDEF0 modeling practice (III)
12. IDEF0 modeling practice (IV)
13. Integrated information environment design (Concept)
14. Integrated information environment design (Data Model)

35030

Chemical Engineering in Global Business

Autumn Semester (2-0-0) (Every year)

Lecturer Hiroshi SAWA, Taizo HANAMITSU, Noritaka MATSUMOTO, Masao NAKAHARA

[Aims]
Chemical engineers are involved in various situations of global business. It is desirable for students to know how to manage and contribute the various problems in such situations. In this course, experienced chemical engineers in various fields introduce the cases which they were involved and explain their experiences in solving various problems. This course will consist of intensive lectures.
[Outline (partly tentative)]
1. Introduction to the course
2. Intensive lectures given by chemical engineers in various companies related to chemical and food industry.

35501
Chemical Engineering Off-Campus Project I,
Spring Semester (0-4-0) for Doctoral degree

35502
Chemical Engineering Off-Campus Project II
Autumn Semester (0-4-0) for Doctoral degree

24521
Materials Science and Technology Off-Campus Project I,
Spring Semester (0-0-4) for Doctoral degree

24522
Materials Science and Technology Off-Campus Project II
Autumn Semester (0-0-4) for Doctoral degree

25511
Organic and Polymeric Materials Off-Campus Project I
Spring Semester (0-4-0) for Doctoral degree

25512
Organic and Polymeric Materials Off-Campus Project II
Autumn Semester (0-4-0) for Doctoral degree
[Aims and scope]
Either of above two projects is required for Doctoral degree. The student will take part in an actual project done by a private company or institution. Project period is from three to six months, in which the student should work more than 160 hrs in total. The student will experience the actual practice in her/his own field and have proper prospects of her/his future profession through this internship projects.

35045
Specific Interdisciplinary Subject in Chemical Engineering A
Spring Semester (0-2-0) (Every year)
Assoc. Prof. Shinsuke MORI

35046

Specific Interdisciplinary Subject in Chemical Engineering B

Autumn Semester (0-2-0) (Every year)

Assoc. Prof. Shinsuke MORI

[Aims]

Chemical engineering is a key concept to establish a methodology of chemical processing and bring about technology breakthroughs relating to fundamental energy and environmental issues. This exercise/drill course utilizes a self-study approach on this subject for students seeking to broaden their knowledge on chemical engineering and to help acquire sufficient problem-solving skills to conduct research on reaction engineering, chemical thermodynamics and transport phenomena in chemical engineering.

35701

Seminar in Chemical Engineering I

Spring Semester (1)

Academic Advisor

35702

Seminar in Chemical Engineering II

Autumn Semester (1)

Academic Advisor

35703

Seminar in Chemical Engineering III

Spring Semester (1)

Academic Advisor

35704

Seminar in Chemical Engineering IV

Autumn Semester (1)

Academic Advisor

35801

Seminar in Chemical Engineering V

Spring Semester (2)

Academic Advisor

35802

Seminar in Chemical Engineering VI

Autumn Semester (2)

Academic Advisor

35803

Seminar in Chemical Engineering VII

Spring Semester (2)

Academic Advisor

35804
Seminar in Chemical Engineering VIII
Autumn Semester (2)
Academic Advisor

35805
Seminar in Chemical Engineering IX
Spring Semester (2)
Academic Advisor

35806
Seminar in Chemical Engineering X
Autumn Semester (2)
Academic Advisor

24701
Seminar in Materials Science and Technology I
Spring Semester (1)
Academic Advisor

24702
Seminar in Materials Science and Technology II
Autumn Semester (1)
Academic Advisor

24703
Seminar in Materials Science and Technology III
Spring Semester (1)
Academic Advisor

24704
Seminar in Materials Science and Technology IV
Autumn Semester (1)
Academic Advisor

24705
Materials Research Methodology I
Spring Semester (1)
Academic Advisor

24706
Materials Research Methodology II
Autumn Semester (1)
Academic Advisor

24707
Materials Research Methodology III
Spring Semester (1)
Academic Advisor

24708
Materials Research Methodology IV
Autumn Semester (1)
Academic Advisor

24801
Seminar in Materials Science and Technology V
Spring Semester (2)
Academic Advisor

24802
Seminar in Materials Science and Technology VI
Autumn Semester (2)
Academic Advisor

24803
Seminar in Materials Science and Technology VII
Spring Semester (2)
Academic Advisor

24804
Seminar in Materials Science and Technology VIII
Autumn Semester (2)
Academic Advisor

24805
Seminar in Materials Science and Technology IX
Spring Semester (2)
Academic Advisor

24806
Seminar in Materials Science and Technology X
Autumn Semester (2)
Academic Advisor

25731
Seminar in Organic and Polymeric Materials I
Spring Semester (1)
Academic Advisor

25732
Seminar in Organic and Polymeric Materials II
Autumn Semester (1)
Academic Advisor

25733
Seminar in Organic and Polymeric Materials III
Spring Semester (1)
Academic Advisor

25734
Seminar in Organic and Polymeric Materials IV
Autumn Semester (1)
Academic Advisor

25735
Research Skills on Organic and Polymeric Materials I
Spring Semester (0-1-0)
Academic Advisor

25736
Research Skills on Organic and Polymeric Materials II
Autumn Semester (0-1-0)
Academic Advisor

25737
Research Skills on Organic and Polymeric Materials III
Spring Semester (0-1-0)
Academic Advisor

25738
Research Skills on Organic and Polymeric Materials Iv
Autumn Semester (0-1-0)
Academic Advisor

25831
Seminar in Organic and Polymeric Materials V
Spring Semester (2)
Academic Advisor

25832
Seminar in Organic and Polymeric Materials VI
Autumn Semester (2)
Academic Advisor

25833

Seminar in Organic and Polymeric Materials VII

Spring Semester (2)

Academic Advisor

25834

Seminar in Organic and Polymeric Materials VIII

Autumn Semester (2)

Academic Advisor

25835

Seminar in Organic and Polymeric Materials IX

Spring Semester (2)

Academic Advisor

25836

Seminar in Organic and Polymeric Materials X

Autumn Semester (2)

Academic Advisor

Dept. of Applied Chemistry

34003

Advanced Molecular Designing

Autumn Semester (2-0-0) (Every Year)

Prof. Koichi MIKAMI

[Aims]

Principal basis of Synthetic Organic Chemistry, Organofluorine Chemistry, and Organometallic Chemistry will be taught. Application of those Chemistry will be emphasized.

[Outline]

I. Introduction

II. Fundamental characteristics of organofluorine compounds

1.Electronic structure

2.Bonding

3.Steric effect

4.Reaction mechanisms

III. Organofluorine chemistry in organic synthesis

1.Fluorine scan in drug design

2.Fluorine scan in material design

3.Fluorinated ligands for catalysts

4.Fluorofunctionalization

5.Building blocks

6.Fluorous chemistry

IV. Recommended literature

V. General conclusions

34021

Organometallic Catalysis

Autumn Semester (2-0-0) (Every Year)

Assoc. Prof. Toshiro TAKAO, Assoc. Prof. Shigeki KUWATA and Assoc. Prof. Masaki OKAMOTO

[Aim and Scope]

This course covers organometallic chemistry, which is essential for the modern organic chemistry and industrial processes. This course describes fundamental theories, preparation, and properties of organometallic compounds as well as their catalytic applications. Advanced topics in this field are also mentioned.

[Outline]

1. Fundamental theories for organometallic chemistry
2. Preparation and properties of organometallic compounds
3. Fundamental reactions of organometallic compounds
4. Representative examples of organometallic catalysis
5. Recent topics in organometallic chemistry
6. Recent topics in heterogeneous catalysis

34022

Advanced Solid State Chemistry for Energy and Environment Issues

Autumn Semester (2-0-0) (Every Year)

Prof. Yuji WADA, Prof. Akira OHTOMO and Assoc.-Prof. Eiichi SUZUKI

[Aims]

This class will cover materials chemistry for energy and environment issues, including nano chemistry, surface chemistry, and solid state chemistry with emphasis on aspects of comdensed matter physics. The lecture will be also extended to the application aspects including photocatalysis, photovoltaics, catalysis, and opto-electronic devices.

[Outline]

Part I Nano Chemistry

Prof. Yuji WADA

1. Introduction to nano chemistry
2. New physical and chemical properties observed by nano-sizing of substances
3. Inorganic nanoparticles of metals, metal oxides, and metal calcogenides
4. Hybrid substances of inorganic nanoparticles with organic moieties
5. Applications of nano substances for the photoenergy conversion

Part II Surface Chemistry

Assoc. Prof. Eiichi SUSUKI

6. Surface Structure
7. Interaction of molecules with surface
8. Chemical reactions on surface
9. Catalysis
10. Applications

Part III Solid State Chemistry

Prof. Akira OHTOMO

Textbook: R. J. D. Tilley: “Understanding Solids: The Science of Materials, 2nd Edition”, John Wiley & Sons, Inc. (2013)

11. Chemical bond and electronic band
12. Phase equilibrium
13. Crystal growth

14. Physical properties
15. Electronic and photonic devices

34701
Seminar in Applied Chemistry I
Spring Semester (1)
Academic Advisor

34702
Seminar in Applied Chemistry II
Autumn Semester (1)
Academic Advisor

34703
Seminar in Applied Chemistry III
Spring Semester (1)
Academic Advisor

34704
Seminar in Applied Chemistry IV
Autumn Semester (1)
Academic Advisor

34801
Seminar in Applied Chemistry V
Spring Semester (2)
Academic Advisor

34802
Seminar in Applied Chemistry VI
Autumn Semester (2)
Academic Advisor

34803
Seminar in Applied Chemistry VII
Spring Semester (2)
Academic Advisor

34804
Seminar in Applied Chemistry VIII
Autumn Semester (2)
Academic Advisor

34805
Seminar in Applied Chemistry IX
Spring Semester (2)

Academic Advisor

34806

Seminar in Applied Chemistry X

Autumn Semester (2)

Academic Advisor