

# SYLLABUS

2015

[D] Interdisciplinary Engineering Course Program



Kyoto University, Graduate School of Engineering

# [D] Interdisciplinary Engineering Course Program

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**Applied Mechanics**

応用力学

【Code】 10G047 【Course Year】 Master 1st 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 Engineering Science Depts Bldg.-216 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Complex Mechanical Systems**

複雑系機械システムのデザイン

【Code】 10X411 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 4th

【Location】 C3-Lecture Room 5 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Mechanical Engineering

先端機械システム学通論

【Code】 10K013 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tue 5th and Thu 4th 【Location】 C3-Lecture Room 5 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Faculty members from several fields

【Course Description】 Lectures on recent topics in various fields of mechanical engineering will be given in English. This is mainly for foreign students (MC/DC), but Japanese students are also welcome.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Mechanics	2	Detailed schedule will be announced later.
Materials	2	
Thermodynamics	2	
Fluid dynamics	2	
Control	2	
Design	2	
Microengineering	2	
Examination/Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class will be given every two years; Not given in 2015.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.

## Applied Numerical Methods

応用数値計算法

【Code】 10G001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiyuki Tsuchiya,

【Course Description】 Numerical techniques, such as the finite element method and numerical control method, are indispensable in mechanical engineering. In this lecture, basics of numerical techniques which are required to study advanced methods for graduated students will be explained. The lecture will cover the error evaluation, linear system solution ( $Ax=b$ ), eigenvalue analysis, interpolation approximation method, solutions of ordinary differential equation and partial differential equation. The programming exercise is included in this lecture.

【Grading】 Home works (assigned about three times) and examination.

【Course Goals】 Understandings of mathematical theories and programming implementations of the numerical methods.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of this class
		Numerical representations and errors
		Macro programming using spread sheet applications
Numerical Error, Approximation	1	Matrix
		Norms
		Singular value decomposition
Linear simultaneous equation 1	2	Solution of simultaneous linear equations
		direct method, iteration method
Eigenvalue analysis	2	Eigenvalue problems
Interpolation	1.5	Interpolation and its errors
Numerical integra 1	1.5	Numerical integration methods
Normal differential equation and numerical integral	2	explicit method, implicit method
		initial value problem, boundary value problem
Partial differential equation	3	Differential expression of partial differential
		Diffusion equation, wave equation
		Poisson equation, Laplace equation
Examination	1	Feedback for homework and examination

【Textbook】 Lecture note will be given.

【Textbook(supplemental)】 Golub, G. H. and Loan, C. F. V., Matrix Computations, John Hopkins University Press  
R.D.Richtmyer and K.W.Morton, Difference Methods for Initial-Value Problems, Second Edition, John Wiley & Sons 1967

【Prerequisite(s)】 Basic mathematics for undergraduates

Basic macro programming

【Independent Study Outside of Class】 Problems are based on macro on Microsoft Excel or OpenOffice (LibreOffice).

【Web Sites】 Panda: <https://panda.ecs.kyoto-u.ac.jp>

【Additional Information】 Have a PC with Microsoft Excel with VBA or Apache OpenOffice(<http://www.openoffice.org/ja/>), LibreOffice (<https://ja.libreoffice.org/>).

**Solid Mechanics, Adv.**

## 固体力学特論

【Code】 10G003 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 S. Biwa, M. Nishikawa

【Course Description】 In Part I, fundamental issues of the finite deformation analysis of solids and structures are introduced, including tensor analysis, kinematics of continua, conservation laws, and various stress/strain measures. In Part II, basic ideas of elastoplastic and viscoplastic theories are lectured to describe nonlinear material properties, and the derivation of inelastic constitutive equations and their application to numerical analyses are also introduced.

【Grading】 Grading is based on the examination, possibly with considerations of the homework reports.

【Course Goals】 The goal is to understand the concepts of finite deformation analysis and inelastic constitutive relations, which constitute the basis of computational mechanics simulations for mechanical/structural design.

## 【Course Topics】

Theme	Class number of times	Description
Part I. Fundamentals of finite deformation analysis		
I-1. Tensor analysis	2	Tensor as a linear transformation; Tensor algebra; Transformation of tensor components due to change of basis; Eigenvalues of symmetric tensors; Spectral decomposition; Integral theorem
I-2. Kinematics	2	Reference and current configurations; Deformation gradient; Cauchy-Green deformation tensors; Polar decomposition; Strain tensors; Velocity and acceleration; Material time derivative; Deformation-rate tensor and spin tensor
I-3. Conservation laws	2	Conservation of mass; Laws of motion by Euler and Cauchy; Cauchy stress tensor; Equation of motion; Conservation of energy
I-4. Various definitions of stress	2	First and second Piola-Kirchhoff stresses; Alternative expression of equation of motion; Principle of virtual power; Objectivity of vectors and tensors; Stress-rate
Part II. Basis of inelastic analyses		
II-1. Constitutive equations of elastoplastic body	3	Models of plasticity for uniaxial tension; Yield functions for isotropic materials; Work hardening; J2 flow theory; Elastoplastic constitutive equations
II-2. Numerical methods for elastoplastic body	2	Incremental virtual work principle; Basis for incremental finite element analyses
II-3. Constitutive equations of elastic-viscoplastic body	2	Models of rate-dependent plasticity; Elastic-viscoplastic constitutive equations based on tangent modulus method

【Textbook】 Parts I, II: Lecture materials are distributed in classroom or to be downloaded on the website.

【Textbook(supplemental)】 Part I: T. Kyoya, "Continuum Mechanics," Morikita (2008); A. J. M. Spencer, "Continuum Mechanics," Dover (1980).

Part II: Y. Tomita, "Foundation and Application of Elastoplasticity," Morikita (1995); E. Neto et al., "Computational Methods for Plasticity," John Wiley & Sons (2008).

【Prerequisite(s)】 Enrolling students are expected to have knowledge in "Mechanics of Materials," "Continuum Mechanics," or "Mechanics of Solids" courses on the undergraduate level.

【Independent Study Outside of Class】 Enrolling students are expected to work on the distributed lecture materials and the homework problems.

【Web Sites】 The URL will be informed during the semester.

【Additional Information】 The order and hours (weights) for each item are subject to possible change.

## Thermal Science and Engineering

熱物理工学

【Code】 10G005 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Yoshida & M. Matsumoto,

【Course Description】 Several topics in advanced thermal physics are discussed. From microscopic view points, basics of stochastic process and related topics are given. From macroscopic ones, after the concept of entropy is revisited, applications in global environments and hydrogen energy are described.

【Grading】 Reports, essays, and/or written examinations.

【Course Goals】 Microscopic Viewpoints: Ability of multi-scale modelling

Macroscopic Viewpoints: Ability of global environment modelling

### 【Course Topics】

Theme	Class number of times	Description
(M) Brownian motion	1	
(M) Transport phenomena and correlation functions	1	
(M) Spectral analysis and fractal analysis	2	
(M) Stochastic process and its applications	3	
(Y) Entropy and free energy: revisit	1	
(Y) Science of atmosphere and ocean	3	
(Y) Hydrogen energy	3	
Check and feedback	1	

【Textbook】 Not specified.

【Textbook(supplemental)】

【Prerequisite(s)】 Elementary thermodynamics, Statistical physics, Heat transfer engineering, Numerical analysis etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 (2014)

Matsumoto: April 13 ~

Yoshida: June 1 ~

**Introduction to Advanced Fluid Dynamics**

基盤流体力学

【Code】 10G007 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Tue 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Condensed Matter Physics**

量子物性物理学

【Code】 10G009 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Thu 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design and Manufacturing Engineering**

設計生産論

【Code】 10G011 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Fri 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Dynamic Systems Control Theory**

動的システム制御論

【Code】 10G013 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Tue 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Engineering Ethics and Management of Technology

技術者倫理と技術経営

【Code】10G057 【Course Year】Master 1st 【Term】1st term 【Class day & Period】Thu 3rd

【Location】Butsurikei-Kousya 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and Exercise

【Language】Japanese 【Instructor】Sawaragi, Nishiwaki, Tomita, M. Komori, Tsuchiya, Noda, Sato, Iseda,

【Course Description】Basic knowledge of Engineering Ethics and Management of Technology needed for future project leaders in companies and society is taught. Students have to make group work after-class hours as well as presentations of wrapping-up the discussions. Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. Management of Technology is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course consists of lectures, exercises, discussions and oral presentations under supervision of professional faculties and extramural lecturers.

【Grading】Submission of reports and presentations

【Course Goals】To cultivate a spirit of self-sufficiency needed for engineers

【Course Topics】

Theme	Class number of times	Description
Engineering Ethics	9	1. Introduction to Engineering Ethics (EE) 2. Medical Engineering Ethics 3. EE by Institution of Professional Engineers, Japan and abroad 4. Product Safety and Product Liability 5. Comprehensive Manufacturing and EE (1) 6. Comprehensive Manufacturing and EE (2) 7. Group Discussions 8. History and Philosophy of EE 9. Presentation on exercise of EE
Management of Technology	5	1. Product Portfolio, Strategy for Competition 2. Business Domain and MOT for Marketing 3. Organizational Strategy for Corporates' R & D 4. Management Theory for R & D 5. Presentation on exercise of MOT
Summary	1	

【Textbook】No textbook

【Textbook(supplemental)】Nothing

【Prerequisite(s)】Nothing particular

【Independent Study Outside of Class】

【Web Sites】No Web Site

【Additional Information】Nothing particular

## Special Topics in Transport Phenomena

移動現象特論

【Code】 10H002 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day & Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlter, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Topics in Transport Phenomena ( English lecture )**

Advanced Topics in Transport Phenomena

【Code】 10H003 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day &amp; Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

## 【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlter, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Fundamentals of Magnetohydrodynamics

基礎電磁流体力学

【Code】 10C076 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 English Lecture

【Language】 English 【Instructor】 Tomoaki Kunugi, Atsushi Fukuyama,

【Course Description】 This course provides fundamentals of magnetohydrodynamics which describes the dynamics of electrically conducting fluids, such as plasmas and liquid metals. The course covers the fundamental equations in magnetohydrodynamics, dynamics and heat transfer of magnetofluid in a magnetic field, equilibrium and stability of magnetized plasmas, as well as illustrative examples.

【Grading】 Attendance and two reports

【Course Goals】 The students can understand fundamentals of magnetohydrodynamics which describes the dynamics of electrically conducting fluids, such as plasmas and liquid metals. Moreover, the students will figure out the applications of magnetohydrodynamics to the various science and engineering fields.

【Course Topics】

Theme	Class number of times	Description
Liquid Metal MHD	7	1. Introduction and Overview of Magnetohydrodynamics 2. Governing Equations of Electrodynamics and Fluid Dynamics 3. Turbulence and Its Modeling 4. Dynamics at Low Magnetic Reynolds Numbers 5. Glimpse at MHD Turbulence & Natural Convection under B field 6. Boundary Layers of MHD Duct Flows 7. MHD Turbulence at Low and High Magnetic Reynolds Numbers
Plasma MHD	8	1. Introduction to Plasma MHD 2. Basic Equation of Plasma MHD 3. MHD Equilibrium 4. Axisymmetric MHD Equilibrium 5. Ideal MHD Instabilities 6. Resistive MHD Instabilities 7. MHD Waves in Plasmas 8. Student Assessment

【Textbook】 Handout of the presentation will be provided at the lecture

【Textbook(supplemental)】 P. A. Davidson, " An Introduction to Magnetohydrodynamics, " Cambridge texts in applied mathematics, Cambridge University Press, 2001

【Prerequisite(s)】 Fundamentals of fluid mechanics and electromagnetism

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Continuum Mechanics

連続体力学

【Code】 10F003 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Kunitomo Sugiura, Tomomi Yagi,

【Course Description】 Continuum mechanics is a unified basis for solid mechanics and fluid mechanics. The aims of this course are to introduce the continuum mechanics from their basics to the some forms of constitutive law and also to provide students with mathematical way of understanding the continuum mechanics. This course contains the fundamentals of vector and tensor calculus, the basic equations of continuum mechanics, the tensor expressions of elastic problems and further applications.

【Grading】 Assessment will be based on exam, report and participation.

【Course Goals】 Fundamental theorems on structural mechanics and design will be learned, and ability to judge the proprieties of each computational structural analysis will be acquired.

### 【Course Topics】

Theme	Class number of times	Description
Introductions	1	
Matrices and tensors	1	
differential and integral calculus of tensors	1	
Kinematics	1	- Material derivative
Deformation and strain	2	- Strain tensors - Compatibility conditions
Stress and equilibrium equation	1	
Conservation law and governing equation	1	
Constitutive equation of idealized material	1	
Elastic-plastic behavior and constitutive equation of construction materials	1	
Boundary value problem	1	
Variational principle	1	
Various kinds of numerical analyses	2	
Confirmation of the attainment level of learning	1	

### 【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for structural mechanics, soil mechanics and fluid mechanics are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Structural Stability

構造安定論

【Code】10F067 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 2nd  
 【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Hiromichi SHIRATO, Kunitomo SUGIURA,

【Course Description】Fundamental concept of static and dynamic stability of large-scale structures such as bridges is to be introduced in addition to the way to keep/improve their safety and to evaluate their performance. Basic concept of structural stability and its application and technical subjects to improve safety will be lectured systematically. Furthermore, the practical solutions to the subjects are to be introduced to assure the safety of structures.

【Grading】Grading will be evaluated by written examination, reports and attendance.

【Course Goals】The class aims to cultivate the understanding of static and dynamic stability problems for structural system and make understand the methodology to clarify the limit state. To get knowledge on countermeasures to assure the stability which is applicable to practical design and manufacturing will be also required.

### 【Course Topics】

Theme	Class number of times	Description
Elastic Stability under Static Loading	7	Stability of Structures and Failures Basis of Structural Stability Elastic Buckling of Columns Elastic Buckling of Beams & Frames Elastic Buckling of Plates Elasto-plastic Buckling Buckling Analysis
Basic theory of dynamic stability and its application	7	The stability around the equilibrium points based on the state equation of motion in which the nonlinearity of external, damping and restrig forces are taken into account. Wind-induced vibration of a square prism (Galopping) and 1dof system with nonlinear spring will be introduced as practical examples. Chaotic motion of a pendulum subjected to periodic external force is also explained as an introduction of chaos theory.
Achievement Check	1	Summary and Achievement Check.

【Textbook】Not specified.

【Textbook(supplemental)】Introduced in class if necessary.

【Prerequisite(s)】It is desired for participants to master structural mechanics, continuum mechanics, mathematical analysis as well as vibration theory.

【Independent Study Outside of Class】

【Web Sites】none

【Additional Information】none

## Structural Dynamics

### 構造ダイナミクス

【Code】10F227 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 1st  
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】Igarashi,Furukawa

【Course Description】 This course deals with dynamics of structural systems and related topics, to provide the theoretical basis to deal with the problems of vibration, safety under dynamic loads and health monitoring associated with infrastructures. The students will study the dynamic response, properties of natural modes and methods of eigenvalue analysis for multi-DOF systems. The topics on the numerical time integration schemes, probabilistic evaluation of structural response to random excitation, and dynamic response control techniques for structures are also studied.

【Grading】 Based on the results of a final examination, plus homework assignments

【Course Goals】 (1) To acquire the knowledge on theories and principles of analysis of MDOF systems (2)

Systematic understanding of frequency-domain structural response analysis (3) Concept of analysis of numerical time integration schemes (4) Understanding of fundamentals of the random vibration theory

#### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Fudamental concepts, harmonic motion
Dynamics of Multi-Degree-Of-Freedom Systems	2	Formulation of Eq. of Motion / Lagrange's method / Normal Modes / Modal Analysis / Modeling of System Damping
Frequency-Domain Analysis of System Response	1	Frequency Response Funcs. / Fourier Transform
Numerical Time Integration	2	Formulation / Stability and Accuracy Analysis of Integration
Random Vibration	6	Overview / Probability Theory / Sequence of i.i.d. Random Variables / Concept of Random Processes / Correlation Funcs. / White Noise / Stochastic Differential Eq. / Lyapunov Eq. / Response to White Noise Excitation / Covariance Matrix Approach / Correlation Funcs. of Random Response / Spectral Representation of Random Processes / Spectral Representation of Structural Response / Application
Structural Response Control	2	Active Control / Semi-Active Control
Achievement Evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Mechanical vibration (undergraduate level), Complex calculus (integration of analytic functions, Fourier transform, etc.), Probability theory, Linear algebra

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There will be homework assignments at the end of most of the lectures.

## Applied Hybrid System Engineering

応用ハイブリッドシステム工学

【Code】10C621 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 1st

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Takashi Hikihara, Shinji Doi, Yoshihiko Susuki, Syun'ichi Azuma,

【Course Description】Many engineering systems show hybrid dynamical structure, which is accompanied with discrete change of vector flow by control and regulate the trajectory to target dynamically. In the course, the fundamental characteristics and theorems are lectured. The framework of hybrid system, automaton model, and singular perturbation theorem are explained. Dynamic quantizer, power system, and network are picked up as examples.

【Grading】Exercise and reports are evaluated.

【Course Goals】Students are requested to understand the characteristics of hybrid system, approaching method, and control methods.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of hybrid system	4	As fundamentals, the definition of hybrid system and the method of modeling is explained.
Singular perturbation and asymptotic expansion	3	Singular perturbation theorems and asymptotic expansion are explained. For the global oscillation of singular perturbed system, analytical and geometrical singular perturbation methods are introduced.
Application of hybrid system-1: power system	3	The application to power system is explained. The outline of power system, then safety and examination, the stability analysis, and the modeling towards control are given.
Application of hybrid system-2: dynamic quantizer	2	As an application, dynamic quantizer is adopted. The outline of the dynamic quantizer, the analysis, and the design of the system are given.
Application of hybrid system-3: networking	3	As an application, the communication network is adopted. The internet network is also explained as an example of modeling and control.

【Textbook】Each professor prepares the prints of lectures.

【Textbook(supplemental)】No textbook.

【Prerequisite(s)】Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This course is held every two years.

## Applied Mathematics for Electrical Engineering

電気数学特論

【Code】10C601 【Course Year】Master Course 【Term】1st term 【Class day & Period】Thu 1st

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】T. Hikihara & S. Doi,

【Course Description】In the class, fundamental mathematics is lectured for electrical engineering, electronics, system engineering, and material science. In particular, system theory, nonlinear dynamics, and particle dynamics in force field can be discussed with mathematical clear image.

【Grading】Students are requested to reply to report assignments. The grading is based on the evaluation of the reports.

【Course Goals】Professors expect students to model their system and analyze the models theoretically. Students will be requested to understand their system in principle mechanics and control them based on system theory.

### 【Course Topics】

Theme	Class number of times	Description
	1	
	2-4	
	3-5	
Introduction 2	1	Relationship between the previous classes and further will be explained. The introduction to nonlinear dynamics will be explained based on oscillation theory.
Hamiltonian mechanics	1-3	Hamiltonian mechanics on linear symplectic space is lectured.
Manifold and vector field	2-4	Manifold is discussed in nonlinear system with relation to vector field analysis.

### 【Textbook】

【Textbook(supplemental)】S. Wiggins, Introduction to Applied Nonlinear Dynamical Systems and Chaos, Springer-Verlag.

【Prerequisite(s)】Linear algebra

### 【Independent Study Outside of Class】

【Web Sites】<https://www.t.kyoto-u.ac.jp/lecturenotes/gse/kueeng/10C601/syllabus>

【Additional Information】Appropriate references will be shown in classes.

## Space Radio Engineering

宇宙電波工学

【Code】 10C612 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 N1 lecture room in the Faculty of engineering building No. 3, A1-131 in Katsura campus, Uji

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hiroshi Yamakawa, Hirotsugu Kojima,

【Course Description】 The present lecture provides the guideline how the technology on the electronics and propulsion system is used for the development of spacecraft and space systems. Furthermore, in order to understand the environment in space, we also give a lecture on the space plasma physics.

【Grading】 attendance and final examination

【Course Goals】 Mastery of the way how we can make use of the knowledges of the physics and technology to the space engineering.

【Course Topics】

Theme	Class number of times	Description
Space environment	2	The space environment in the view point of spacecraft desing such as thermal condition, plasmas, and charging.
Spacecraft system and its related technology	5	The spacecraft system and its technology related to power system, communication system, EMC, and payload desings.
Spacecraft dynamics	3	Spacecraft orbit design and its attitude control
System engineering of spacecraft	4	Spacecraft propulsion system including the advanced systems which make use of solar power, GPS navigation system, and space debris
Feedback	1	We will give a feedback lecture by answering to questions from students.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Plasma physics, Electromagnetics. Radio engineering, Electronics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Fracture Mechanics

破壊力学

【Code】10G017 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Fri 1st

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Takayuki Kitamura,

【Course Description】The basics of the fracture mechanics will be lectured.

Elastic problem, Stress function of a crack, Stress field around a crack tip, Stress intensity factors, Energy release rate, J-integral, Elastic plastic fracture mechanics, Interfacial fracture mechanics etc.

Fracture toughness, Crackings in fatigue, environmental fatigue and creep-fatigue etc.

【Grading】Mini-reports will be evaluated.

【Course Goals】The objective of this lecture is to master the basic knowledge of the fracture mechanics, and to be able to discuss about material strength on the basis of the knowledge.

【Course Topics】

Theme	Class number of times	Description
Introduction	2	Introduction
		Examples of fracture in real components
		Deformation and fracture
		Stress concentration and singular stress field
		Basics of solid mechanics
Linear fracture mechanics	3	Mechanics of cracked body under linear elasticity
		Singular stress field near a crack tip, Stress intensity factor, Energy release rate, J-integral, Small scale yielding
		Interfacial fracture mechanics in dissimilar materials, Stress field near an interface edge, Stress field near an interfacial crack
Nonlinear fracture mechanics	2	Fracture mechanics in non-linear elastic solid
		HRR singular field, J-integral, creep
		Stress field near an interface edge
Fracture phenomenon and mechanics	3	Application of fracture mechanics to fracture toughness
		Application of fracture mechanics to fatigue cracking
		Application of fracture mechanics to environmental cracking
		Application of fracture mechanics to fatigue cracking at high temperatures
Fracture mechanics on growth of small cracks	1	Growth of physical small crack
		Growth of microstructurally small crack
Crack and cavity in creep	1	Cavity growth by diffusion creep
		Difference of stress field between crack and cavity
Fracture nanomechanics	1	Research works on fracture mechanics in nanometer scale
Fracture in atomic scale	1	Research works on fracture in atomic scale
Summary	1	Discussion and report

【Textbook】The teacher provide articles for this lecture.

【Textbook(supplemental)】

【Prerequisite(s)】The traditional material strength and the linear elastic mechanics should be learned before taking this lecture.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd  
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice  
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

### 【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

### 【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Strength of Advanced Materials

### 先進材料強度論

【Code】 10B418 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 M. Hojo and M. Nishikawa,

【Course Description】 The mechanism underlying mechanical and functional properties are lectured for advanced materials used and developed in advanced fields of current engineering. In particular, advanced composite materials, used for aircraft structure etc., are introduced, with a detailed description of the relationship between microscopic constituent materials and macroscopic properties from the perspective of multiscale mechanics; also the anisotropy of their properties, their fatigue and fracture properties are described in the basic discipline for strength of materials. The latest applications are introduced in the field of various transportation systems including airplanes.

【Grading】 Grading is based on the reports. The assignments will be given around three times.

【Course Goals】 The course goal is to understand basic concepts of composite materials and the underlying mechanism of their mechanical properties from multiscale viewpoints, while the physical understanding of composites is developed based on multiple disciplines.

#### 【Course Topics】

Theme	Class number of times	Description
Concept of composite materials	2	The concept and definition of composite materials, their constituent materials and manufacturing methods are illustrated. Their application to aircraft structures etc. are also introduced.
Mechanical properties of microscopic constituent materials	2	Resin for matrix and various fiber types are explained including their structure and mechanical properties. The weakest link model and Weibull distribution are described as a basis of the statistic nature of strength.
Basic mechanical properties	4	The specific strength, the specific stiffness, and the rule of mixture for elastic modulus and strength are lectured. In particular, the detailed explanation is made to the anisotropy of elastic modulus, independent elastic constants in the generalized Hookean law, the anisotropic failure criteria, and laminate theory. The relationship between the mechanical properties of microscopic constituent materials and macroscopic properties of composite materials is also illustrated.
Micromechanics	2	The mechanism of transverse fracture is illustrated. The mechanical models are described for short fiber reinforced composites and particle dispersed composites. The micromechanical analyses based on finite element method is also illustrated for the physical understanding of the strength of composite materials.
Fracture mechanics properties	2	Fracture mechanics of anisotropic materials are described. The interlaminar fracture toughness and interlaminar fatigue crack propagation, the critical issues in the application of composite structures, are explained including their underlying mechanism.
Superconducting materials	1	High-temperature superconducting materials are the composite materials consisting of metals and fibrous superconducting materials made of oxides. The mechanism are explained for understanding that their mechanical properties so much control their electric properties.
Process and mechanical properties of composite materials	1	The molding and machining process of composite materials is explained to relate it to their mechanical properties. Fiber preform, the selection of resin, intermediate materials, machining and assembly and inspection methods are overviewed from the academic viewpoints.
Academic achievement test	1	Academic achievements is assessed.

【Textbook】 Supplementary handouts will be distributed in the class.

【Textbook(supplemental)】 D.Hull and T.W.Clyne, "An Introduction to Composite Materials," Cambridge University Press.

【Prerequisite(s)】 Mechanics of Materials, Continuum Mechanics, Fundamentals of Materials, Solid Mechanics, Adv.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The order and the item in the course are possibly subject to change.

## Dynamics of Solids and Structures

動的固体力学

【Code】 10G230 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 S. Biwa and T. Hayashi

【Course Description】 Fundamental principles for dynamic deformations of solids and structures are examined. In particular, basic characteristics of elastic wave motion in solid media are emphasized. Responses of materials and structures to impact loading are also considered.

【Grading】 Grading is based on the attendance, homework reports and the final examination (possibly replaced by reports).

【Course Goals】 This course aims to establish the understanding of basic characteristics of dynamic deformations and elastic waves in solid media, as well as to learn about technological applications of ultrasound in a variety of fields extending from micro- to macro-scales. Particular emphasis is put on the mathematical aspects of the physical phenomena involved.

### 【Course Topics】

Theme	Class number of times	Description
Fundamentals of elastodynamics	1	Expressions of stress and strain; Conservation laws; Hooke's law; Principle of virtual work; Hamilton's principle and its applications
Basics of wave propagation	2	One-dimensional wave equation; D'Alembert's solution; Harmonic waves; Spectral analysis; Waves in structural members; Dispersive waves; Phase and group velocities
Stress waves in a bar	1	Reflection and transmission at bi-material connection; Reflection at a free end; Stress wave by tensile loading at a bar end; Plastic wave
Waves in isotropic elastic media	1	Navier's equations; Longitudinal and transverse waves; Plane elastic waves in isotropic solids
Waves in anisotropic elastic media	2	Voigt representation; Plane elastic waves in anisotropic solids; Christoffel's equation; Propagation and polarization directions; Slowness surfaces
Reflection and transmission	2	Reflection and transmission of normal incident waves; Snell's law; Mode conversion; Reflection and refraction of oblique incident waves.
Guided elastic waves	2	Bulk waves and guided waves; Rayleigh wave; Love wave; Lamb wave.
Numerical analysis of elastic waves	2	Finite difference method; Finite element method; Boundary element method
Measurements of vibration and waves	2	Comparison of various measurement techniques; Analogue and digital data analysis

【Textbook】 No textbooks are assigned. The lecture is mainly given in a blackboard style. Print-outs are handed in when needed.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of mechanics of materials (solid mechanics, continuum mechanics) is expected.

【Independent Study Outside of Class】 Enrolling students are expected to work on the lecture materials and the homework problems.

【Web Sites】

【Additional Information】 The time units and weights for each item on the above list are subject to possible changes.

## Thermophysics for Thermal Engineering

熱物性論

【Code】 10B622 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 M. Matsumoto

【Course Description】 Based on elementary thermodynamics and statistical physics, I will describe non-equilibrium thermodynamics and advanced statistical physics, including phase transition, pattern formation, and entropy production.

【Grading】 Paper assignments

【Course Goals】 Understanding the principle mechanisms of phase transition, cooperation phenomena, pattern formation, and relaxation phenomena, in terms of advanced statistical mechanics and non-equilibrium thermodynamics.

【Course Topics】

Theme	Class number of times	Description
Elementary statistical physics: review	1	Review of equilibrium statistical mechanics
Phase transition as a cooperative phenomenon	3	Statistical mechanics of interacting particle system - Exact calculation - Monte Carlo simulation - Mean field approximation
Pattern formation of non-equilibrium systems	4	After a time dependent Ginzburg-Landau (TDGL) model is introduced, formation of spatial patterns is discussed from various viewpoints.
Equilibrium thermodynamics: review	1	Review of elementary thermodynamics
Non-equilibrium thermodynamics: Basics	2	System stability and the principle of irreversible process are discussed in terms of thermodynamics.
Non-equilibrium thermodynamics: Applications	3	- Entropy production - Linear response theory - Onsager's reciprocal relation
Check and Feedback	1	

【Textbook】 Lecture note will be prepared.

【Textbook(supplemental)】

【Prerequisite(s)】 Undergraduate level of Thermophysics, Heat transfer phenomena, and Statistical physics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Transport Phenomena

熱物質移動論

【Code】 10G039 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd  
 【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese  
 【Instructor】 Nakabe, Kazuyoshi, Tatsumi, Kazuya,

【Course Description】 The important learning objective of this class is to understand the fundamental mechanisms of momentum, heat, and mass transfer phenomena, the knowledge of which will be markedly required for the thermal energy control technologies to further practice conservations of natural resources and energies for sustainable development. Heat and mass transfer processes consisting of conduction and forced/natural convection will be highlighted in detail, referring to the similarity characteristics of flow velocity, fluid temperature, and species concentration. Some topics on Reynolds stress, turbulent heat flux, and phase change will be introduced, expanding to their numerical models, together with some recent trends of high-tech heat and energy devices.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Surrounding Examples of Transport Phenomena	1	
Governing Equations and Non-Dimensional Parameters	3 ~ 4	
Boundary Layer Flows	2 ~ 3	
External and Internal Flows	1 ~ 2	
Turbulent Phenomena	2 ~ 3	
Topics of Flow and Heat Transfer Mechanism	2 ~ 3	
Estimation on Study Achievement	1	

【Textbook】

【Textbook(supplemental)】 Example: Transport Phenomena (Bird, R.B. et al.)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Molecular Fluid Dynamics

分子流体力学

**【Code】** 10G019 **【Course Year】** Master 1st **【Term】** 2nd term **【Class day & Period】** Tue 1st **【Location】**  
**【Credits】** 2 **【Restriction】** **【Lecture Form(s)】** Lecture **【Language】** Japanese **【Instructor】** K. Aoki & S. Kosuge  
**【Course Description】** This course aims at reviewing and supplementing the introductory molecular gas dynamics that is taught as a part of the course “ Introduction to Advanced Fluid Dynamics ” in the first semester. In this course, low-pressure gas flows and gas flows in micro scales (i.e., the so-called non-equilibrium gas flows) are considered. In molecular gas dynamics, the notions of intermolecular collisions (or interactions) and molecular velocity distribution function, which are not included in ordinary fluid and gas dynamics, are required, and some efforts are needed to master these notions. Once they have been mastered, however, it becomes easier to understand various phenomena arising in fluid and gas dynamics. The final aim of the present course is to master these notions.

**【Grading】** Some reports for exercises are required, on the basis of which the evaluation is made. The rate of attendance at the course is also taken into account for evaluation.

**【Course Goals】** The notion of kinetic theory based on the velocity distribution function is to be mastered, and the ability of understanding and applying kinetic modeling, which prevails in various fields, is to be cultivated.

### 【Course Topics】

Theme	Class number of times	Description
Review of basic things	3	The definition of the velocity distribution function and its relation to macroscopic quantities, the transport of physical quantities, and the Boltzmann equation are reviewed.
Supplement to basic things	4	The symmetry relations for the extended collision integral, the boundary conditions for the Boltzmann equation, the H theorem and the Darrozes-Guiraud inequality, model Boltzmann equations, exact solutions of the form of local Maxwellian distribution, the mean free path, and nondimensionalization are explained or proved.
Generalized slip-flow theory	4	When the Knudsen number is small, a systematic asymptotic analysis of the steady boundary-value problem of the Boltzmann equation leads to partial differential equations of fluid-dynamic type and their boundary conditions of slip type. An introduction to this theory is given.
DSMC method	4	For general Knudsen numbers, direct numerical solution of the Boltzmann equation is needed. The DSMC method, which is one of the standard numerical methods, is introduced briefly, and some numerical examples are presented.

### 【Textbook】

**【Textbook(supplemental)】** Y. Sone & K. Aoki, Molecular Gas Dynamics (Asakura, Tokyo, 1994) (in Japanese); Y. Sone, Molecular Gas Dynamics (Birkhauser, Boston, 2007).

**【Prerequisite(s)】** It is required to have followed the course “ Introduction to Advanced Fluid Dynamics ” in the first semester.

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

## Engineering Optics and Spectroscopy

光物理工学

【Code】 10G021 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Masahiro Hasuo, Taiichi Shikama

【Course Description】 Optics are widely used in many areas of modern science and technology. Students will learn the physical properties of light and light-matter interactions, and their applications. Topics such as light propagation in dielectric media, crystal optics, quantum optics, and lasers will be explored. Interactions of light with atoms, molecules and solids as examples will be also explored with introduction of the fundamentals of spectroscopy and their applications.

【Grading】 Grade evaluation will be based on report examination.

【Course Goals】 Understand the principles of optical engineering and spectroscopy.

Develop application abilities based on the principle understanding.

### 【Course Topics】

Theme	Class number of times	Description
Dispersion of light	6	propagation of light in dielectric media (Lorentz model), crystal optics, nonlinear optics
Quantum optics	1	quantum theory of light, principles of lasers
Light-matter interactions	5	light-induced transition, quantum states of atoms, molecules, and solids, and rules governing the transitions (selection rules)
Selection rules and group theory	2	introduction to group theory and its application to the selection rules
Confirmation of the achievement	1	

【Textbook】 Recommended books will be discussed in class.

【Textbook(supplemental)】 Lecture notes will be distributed.

【Prerequisite(s)】 Undergraduate-level electromagnetism and quantum mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physics of Neutron Scattering**

中性子物理学

【Code】10B628 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 4th

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】T. Fukunaga, K. Mori,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**High Energy Radiation Effects in Solid**

高エネルギー材料工学

【Code】 10B631 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 A. Kinomura, Q. Xu

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Experimental Techniques and Analysis in Engineering Physics**

先端物理工学実験法

【Code】 10B634 【Course Year】 Master and Doctor Course 【Term】 (intensively; in summer vacation)

【Class day &amp; Period】 【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Robotics**

ロボティクス

【Code】 10B407 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Fumitoshi Matsuno,

【Course Description】 Understanding of intelligent behaviors of living things is very interesting. And realization of their intelligent motion by a robot is also attractive for mechanical engineering. In this lecture, we consider basic understanding of beautiful human skill “ manipulation ” on the point of view of dynamics and control. First modeling methodologies for a rigid multibody system and a general dynamic model of a manipulator are provided. Next, a typical nonlinear control law is introduced and some problems for applying the controller are shown. Based on nature of the dynamics of the manipulator, a very simple and robust controller can be derived by designing energy of the system. This lecture provides modeling methodologies and controller design strategies of the rigid multibody system and we analyze a beautiful human skill of the manipulation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	3	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Mechanical Functional Device Engineering**

メカ機能デバイス工学

【Code】 10G025 【Course Year】 Master 1st 【Term】 2nd term 【Class day &amp; Period】 Wed 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	1	
	1	
	1	
	1	
	1	
	1	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Theory for Design Systems Engineering

デザインシステム学

【Code】 10Q807 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tetsuo Sawaragi and Hiroaki Nakanishi,

【Course Description】 The lecture focuses on the human design activity; designing artifacts (things, events and systems) based on human intuitions, and designing human-machine systems in which the relations between human and objects are of importance.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	3	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## High Precision Engineering

超精密工学

【Code】 10B828 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese+English 【Instructor】 Ari Ide-Ektessabi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to High Precision Analysis Using Synchrotron Radiations
High precision Measurement	2	Synchrotron Radiation and X-ray Fluorescence Spectroscopy
High precision Measurement	3	Micro Imaging and Quantitative XRF micro Analysis
High precision Measurement	4	Fine Structure Spectroscopy
High precision Measurement	5	Fine Structure Spectroscopy
High precision Measurement	6	Synchrotron Radiation Measurement
Applications in bio-nano technology	7	Elemental Images of Single Neurons by Using SR-XRF I
Applications in bio-nano technology	8	Elemental Images of Single Neurons by Using SR-XRF II
Applications in bio-nano technology	9	Elemental Imaging of Mouse ES Cells(Application)
Applications in bio-nano technology	10	Application of Synchrotron Radiation in the Investigation of process of neuronal differentiation
Applications in bio-nano technology	11	Chemical State Imaging for Investigations of Neurodegenerative Disorders (Parkinsonism-Dementia Complex)
Applications in bio-nano technology	12	Chemical State Imaging for Investigations of Neurodegenerative Disorders: Chemical State of Iron in Parkinsonism Dementia Complex (PDC)
Applications in bio-nano technology	13	Comparison with other techniques
Applications in bio-nano technology	14	Comparison with other techniques
	15	

【Textbook】

【Textbook(supplemental)】 Application of Synchrotron Radiation, Arid Ide-Ektessabi, Sp ringer 2007

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://ocw.kyoto-u.ac.jp/graduate-school-of-engineering-jp/ultra-high-precision-analysis/schedule>

【Additional Information】

**Biomechanics**

バイオメカニクス

【Code】 10V003 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Introduction	1	
	2	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomolecular Dynamics**

生体分子動力学

【Code】 10D450 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	3	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Environmental Fluid Dynamics**

環境流体力学

【Code】10B440 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	6	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Turbulence Dynamics**

乱流力学

【Code】 10Q402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Hanazaki,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	4	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Crystallography of Metals

## 金属結晶学

【Code】 10G055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese  
【Instructor】 ,

【Course Description】 Metallic crystal structure and deformation behavior are lectured on the basis of metal physics and dislocation theory. Especially, mechanical properties of dislocation and its substructure, which is changed in association with deformation, are introduced, and the effect of grain boundary and free surface on dislocation motion is explained.

【Grading】 Reporting assignment

【Course Goals】 The objective of this lecture is to deepen a further understanding of crystal growth methods, the dislocation theory and industrial problems.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
		Ideal strength and slip deformation
		Concept of dislocation
		Simulation
Basis of crystallography	1	Typical crystallographic structure
		Allotropic transformation
		Stereographic projection of crystal
High temperature and vacuum techniques	1	Furnace
		Vacuum pump
Crystal breeding	2	Single- and bi-crystal growth
		Crystal growth
		Vapor deposition and thin film
Dislocation theory	3	Plastic deformation of crystal
		Definition and type of dislocation
		Strain field around dislocation
		Dislocation reaction
Mechanical properties of single- and bi-crystals	1	Dislocation substructure
		Grain boundary structure
		Reaction between dislocation and grain boundary
		Deformation of micro- and nano- materials
Fatigue	3	Fatigue of single crystal
		Fatigue dislocation substructure
		Fatigue cracking mechanism
		Fatigue of micro- and nano- materials
Observation and analysis techniques	2	Introduction of electron microscope and observation case
Summary	1	Discussion and report

【Textbook】 The teacher provide articles for this lecture.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar: Dynamics of Atomic Systems**

原子系の動力学セミナー

【Code】10Q610 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 5th

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture + Exercise

【Language】Japanese 【Instructor】M. Matsumoto, M. Nishikawa, R. Matsumoto, T. Shimada, Y. Inoue

【Course Description】 Particle simulations are a tool of analyzing microscopic phenomena, and widely used in various fields of science and engineering. After providing the basics of particle simulation methods through lectures and exercises, we show various practical applications in thermofluids, solid materials, biophysics, and quantum systems.

【Grading】 Reports, presentation/discussion

【Course Goals】 - Understanding the basics of particle simulations - Mastering data analysis techniques

【Course Topics】

Theme	Class number of times	Description
Basics of MD simulations (M.Matsumoto)	4	- Numerical simulation of equations of motion - Model potentials - Data analysis - Equilibrium vs. non-equilibrium
Application: Thermofluidal systems (M. Matsumoto)	2	- Lennard-Jones fluids - Interface, phase change, energy transport, etc.
Application: Polymeric materials (Nishikawa)	2	- Fundamentals on mechanical (viscoelastic) properties of polymer materials - Application of molecular dynamics method of polymer materials
Application: Biosystems (Inoue)	2	- MD simulation of biomolecular systems - Recent examples
Application: Solid systems (R. Matsumoto)	2	- Deformation and destruction - Alternative methods
Application: Quantum systems (Shimada)	2	- First principle MD - Mechanical and electronic properties on nanoscale
Check and Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Elementary Level of

Analytical mechanics, Quantum mechanics, Material science, Thermodynamics, Statistical physics, Numerical analysis

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Neutron Science Seminar 1**

中性子材料工学セミナー

【Code】 10V007 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	2-3	
	2-3	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Neutron Science Seminar II**

中性子材料工学セミナー

【Code】 10V008 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	9	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Applied Mechanics A**

応用力学セミナー A

【Code】10W025 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	-	
	-	
	-	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Applied Mechanics B**

応用力学セミナー B

【Code】10W027 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	-	
	-	
	-	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Patent Seminar**

特許セミナー

【Code】10G029 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Fri 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	2	
	2	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Micro Process and Material Engineering**

マイクロプロセス・材料工学

【Code】 10G203 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Kotera, O. Tabata, K. Eriguchi, I. Kanno, T. Tsuchiya,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Semiconductor microfabrication	3	
Thin-film process and evaluation	3	
Silicon micromachining	3	
3D lithography	3	
Soft-micromachining	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Microsystem Engineering

マイクロシステム工学

【Code】 10G205 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Fri 4th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 O. Tabata, H. Kotera, T. Tsuchiya, R. Yokokawa,

【Course Description】 Microsystem covers not only technologies related to individual physical or chemical phenomenon in micro scale, but also complex phenomena which are evolved from their interaction. In this course, the physics and chemistry in micro and nanoscale will be lectured in contrast to those in macro scale. The various kinds of application devices (ex. physical (pressure, flow, force) sensors, chemical sensors, biosensors, actuators (piezoelectric, electrostatic, and shape memory) and their system are discussed.

【Grading】 The evaluation will be based on the reports given in each lecture.

【Course Goals】 Understand the theory of sensing and actuating in microsystem. Acquire basic knowledge to handle various kinds of phenomena in microscale.

### 【Course Topics】

Theme	Class number of times	Description
MEMS modeling	2	Multi-physics modeling in microscale. Electro-mechanical coupling analysis.
MEMS simulation	2	System level simulation in MEMS.
Electrostatic microsystem	3	Electrostatic sensors and actuators. Theory and application devices.
Physical sensors	4	Physical sensors as a fundamental application in microsystem. Accelerometer, vibrating gyroscope, pressure sensors.
Micro total analysis system	4	Chemical analysis system and bio-sensing device using microsystem.

【Textbook】 Provided in the lecture.

【Textbook(supplemental)】 Provided in the lecture.

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering".

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student can register only to this class 10G205, but it is required to be able to take consecutive classes at Friday 4th and 5th. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term. The student of this class is strongly recommended to take a course 10V201 "Introduction to the Design and Implementation of Micro-Systems"(10V201), which is a practice for designing microsystem. Those who want to take 10V201 have to take training course for CAD in advance.

**Multi physics Numerical Analysis**

マルチフィジクス数値解析力学

【Code】 10G209 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 1st

【Location】 Engineering Science Depts Bldg.-101 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	5	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Theory of Condensed Matter**

量子物性学

【Code】 10B619 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Akitomo TACHIBANA

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	3	
	6	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Solid State Physics 1**

物性物理学 1

【Code】 10G211 【Course Year】 Master 1st 【Term】 2nd term 【Class day &amp; Period】 Wed 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1-2	
	1	
	1	
	1 -2	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1-2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Precision Measurement and Machining

精密計測加工学

【Code】10G214 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd

【Location】C3 seminar room c1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】A. Matsubara and S. Ibaraki,

【Course Description】 This course gives the principles of precision measurement and machining process for the meso-micro-nano metric fabrication. The optical measurement technologies (e.g. laser interferometer, optical encoders) and cutting technologies (e.g. cutting mechanics, tool, machine) are shown.

【Grading】 Small exams in the term and the final exam

【Course Goals】 Understand the basic principles of precision measurement and machining associated with the applications

【Course Topics】

Theme	Class number of times	Description
Basics of measurement and machining	1	Concept of accuracy, precision, Relation of measurement, machining, and control
Basics of precision measurement	2	
Optical measurement	4	
	3	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Introduction to the Design and Implementation of Micro-Systems

微小電気機械システム創製学

【Code】 10V201 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 C3-Lecture room 1 or 3 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture and Pactice 【Language】 English

【Instructor】 O. Tabata,H. Kotera,T. Tsuchiya,R. Yokokawa,

【Course Description】 This is a joint lecture with Hong Kong University of Science and Technology (HKUST). A team consists of two students from each University work together to fullfill the assignment (design a microsystem) through paper survey, analysis,design, and presentation. A student can acquire not only the basic knowledge of a microsystem, but also comprehensive ability of English such as technical knowledge in English, skill for team work, and communication.

【Grading】 Presentation, Assignments, and Achievement

【Course Goals】 Acquire the knowledge and skill to design and analyze a microsystem.

【Course Topics】

Theme	Class number of times	Description
Tutorial on microsystem CAD software	3	Master CAD program for microsystem design and analysis which will be utilized to accomplish an assignment.
Lecture and Task Introduction	2	Learn basic knowledge necessary to design a microsystem/MEMS(Micro Electromechanical Systems) utilizing microfabrication technology.
Design and analysis work	3	Analyze and design a microsystem by communicating with a team member of HKUST.
Presentation I	2	The designed device and its analyzed results is presented in detail by team in English.
Evaluation of device	3	Evaluate the fabricated microsystem.
Presentation II	2	The measured results and comparison between the analyzed results of the fabricated microsystem is presented by team in English.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering" provided in 1st term.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student of this class is required to register to the course 10G205 "Microsystem Engineering" provided at Friday 4th so as to be able to take consecutive classes at Friday 4th and 5th. Those who want to take this course have to take training course for CAD in advance. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term.

**Introduction to Biomedical Engineering**

医工学基礎

【Code】10W603 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Theory of Molecular Physics**

量子分子物理学特論

【Code】 10B617 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-2	
	3-4	
	5	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Theory of Chemical Physics**

量子化学物理学特論

【Code】10Q408 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Akitomo TACHIBANA

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	4	
	4	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Solid State Physics 2**

物性物理学 2

【Code】 10V205 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Thu 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4-5	
	4-5	
	4-5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Transport Phenomena in Reactive Flows

Transport Phenomena in Reactive Flows

【Code】 10G423 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 YOSHIDA Hideo, IWAI Hiroshi,

【Course Description】 This lecture is designed for the students who want to gain their knowledge and understanding on transport phenomena associated mainly with convective flows with chemical reactions. It starts with a brief review of undergraduate level subjects followed by more advanced discussion on heat and mass transfer with reactions. The reactions of interest in the lecture include combustion (oxidation), reforming and electrochemical reactions. As the reactions may proceed on catalysts, the discussion covers the catalytic surface reactions, reactions in porous media as well as gas phase reactions. The students are expected to have learned fundamentals of Fluid dynamics, Thermodynamics and Heat transfer during their undergraduate courses.

【Grading】 Grade evaluation is based on attendance, short reports and one's term paper submitted at the end of the semester.

【Course Goals】 Starting from the basic heat and mass transfer, the lecture aims to expand the students' comprehensive understanding on transport phenomena in physicochemical processes including thermochemical and electrochemical reactions.

### 【Course Topics】

Theme	Class number of times	Description
Transport phenomena in reactive flows	14	Transport phenomena in convective flows with chemical reactions including combustion (oxidation), reforming and electrochemical reactions.
Achievement Confirmation	1	Achievement Confirmation

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Fluid dynamics, Thermodynamics, Heat transfer

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This course will not be opened in 2015.

**Jet Engine Engineering**

ジェットエンジン工学

【Code】 10G401 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3-4	
	3-4	
	2-3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Optimum System Design Engineering**

最適システム設計論

【Code】 10G403 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	5	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Propulsion Engineering, Adv.**

推進工学特論

【Code】 10G405 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	4	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Gas Dynamics, Adv.**

気体力学特論

【Code】10G406 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	4	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Aerospace Systems and Control**

航空宇宙システム制御工学

【Code】 10G409 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Fluid Dynamics for Aeronautics and Astronautics**

航空宇宙流体力学

【Code】 10G411 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	3	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Flight Dynamics of Aerospace Vehicle

航空宇宙機力学特論

【Code】 10C430 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Kei Senda,

【Course Description】 Flight Dynamics and Control of Aerospace Vehicles including Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

【Grading】 Evaluation depends on marks of examination and exercises.

【Course Goals】 To understand analytical mechanics through flight dynamics of aerospace vehicles: Basic items of Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

### 【Course Topics】

Theme	Class number of times	Description
Analytical Mechanics	7	1. Newton equations, 2. Lagrange equations, 3. Hamilton equations
Orbital Mechanics	4	1. Motions in central force field, 2. Conservation law, 3. Orbit transition
Attitude Dynamics and Control	4	1. Kinematics of rotation, 2. Attitude mechanics, 3. Stability analysis of equilibrium points, 4. Attitude Control

### 【Textbook】

【Textbook(supplemental)】 L. D. Landau and E. M. Lifshitz: Mechanics, Volume 1 (Course of Theoretical Physics

Herbert Goldstein: Classical Mechanics

Toda and Nakajima: Introductory course of physics #1, #2, #10, etc. (Iwnami Shoten)

【Prerequisite(s)】 Foundation of mechanics and mathematics, Flight Dynamics of Aerospace Vehicle (Undergraduate)

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

**Seminar on Engineering Science of Ionized Gases**

電離気体工学セミナー

【Code】 10V401 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Mon 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Molecular Gas Dynamics**

分子流体力学セミナー

【Code】 10V010 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Gas Dynamics**

気体力学セミナー

【Code】 10V412 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Fluid Dynamics for Aeronautics and Astronautics**

航空宇宙流体力学セミナー

【Code】10V405 【Course Year】Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 5th

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	14	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Aerospace systems**

航空宇宙機システムセミナー

【Code】10R410 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 4th

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Aerospace Systems	15	1. Reading textbooks 2. Reviewing journal papers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Systems and Control**

システム制御工学セミナー

【Code】 10R419 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Optimum System Design Engineering**

最適システム設計工学セミナー

【Code】10V407 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Tue 3rd

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar and Exercise

【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Thermal Engineering Seminar**

熱工学セミナー

【Code】 10V409 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 3rd

【Location】 C3-Lecture Room 3 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Seminar on Mechanics of Functional Solids and Structures

機能構造力学セミナー

【Code】 10V413 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 S. Biwa and T. Hayashi

【Course Description】 This Seminar is to review advanced topics related to materials and structural systems involved in aeronautics and astronautics, as well as to nurture the presentation and discussion skills. Specific topics include the numerical methods for dynamic behavior of thin-walled structures and composite/functional materials, and advanced experimental techniques for structural health monitoring.

【Grading】 Grading is based on the literature survey, presentation, discussion and the final report.

【Course Goals】 The goal is to nurture the skills to survey and discuss advanced topics in the mechanics of functional materials and structures as well as structural health monitoring, and to utilize them in carrying out the research project.

### 【Course Topics】

Theme	Class number of times	Description
Subject setting	3	Literature survey is to be carried out for advanced topics in the mechanics of functional materials and structures as well as structural health monitoring.
Presentation and discussion	11	The results of literature survey are presented and discussed with the critical evaluations for them.
Assessment	1	The achievement is assessed by the final report.

【Textbook】 No textbooks are assigned.

【Textbook(supplemental)】

【Prerequisite(s)】 Enrolling students are expected to have the fundamental knowledge of solid mechanics and to be willing to work on advanced topics in the mechanics of solids/structures.

【Independent Study Outside of Class】 Enrolling students are expected to carry out the literature survey and to prepare the presentation.

【Web Sites】

【Additional Information】 The time units of each stage are subject to change depending on each year's conditions and due to the discussion by Instructors/students.

**Theory of Symbiotic Systems**

共生システム論

【Code】 693518 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Mon 4th

【Location】 Integrated Research Bldg.-213 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】 Various theories on developing and maintaining harmonious symbiosis among humans, artifacts, and environments are lectured and discussed. Topics include typical forms of harmonious coexistence such as in ecological systems, caring and artistic nature of communication and interactions, philosophical discussions on deep-ecology, and methodologies for designing symbiotic systems.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	3	
	3	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Control Theory for Mechanical Systems**

機械システム制御論

【Code】 693510 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 2nd

【Location】 Engineering Science Depts Bldg.-315 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3-4	
	2-3	
	3-4	
	3-4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Theory of Human-Machine Systems**

ヒューマン・マシンシステム論

【Code】693513 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】..

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	2	
	3	
	3	
	1-2	
	1-2	
	1-2	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Dynamical Systems,Advanced**

力学系理論特論

【Code】 693431 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 4th

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	2	
	2	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Topics in Nonlinear Dynamics A**

非線形力学特論 A

【Code】 693320 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 2nd

【Location】 Integrated Research Bldg.-111 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	
	1-3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Topics in Nonlinear Dynamics B**

非線形力学特論B

【Code】693321 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Heat Engine Systems**

熱機関学

【Code】 653316 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Tue 3rd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
	1	
	1	
	2	
	2	
	1	
	1	
	2-3	
	2-3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Combustion Science and Engineering**

燃焼理工学

【Code】 653322 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Tue 1st 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	Class number of times	<b>Description</b>
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Meteorology I**

気象学

【Code】10M226 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	Class number of times	<b>Description</b>
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Meteorology II**

気象学

【Code】10M227 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Wed 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
	3 ~ 4	
	3 ~ 4	
	3 ~ 4	
	3 ~ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to Advanced Nuclear Engineering**

基礎量子エネルギー工学

【Code】10C072 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Nuclear Energy Conversion and Reactor Engineering**

核エネルギー変換工学

【Code】 10C034 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 KAWARA,KUNUGI,YOKOMINE,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	2	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physics of Fusion Plasma**

核融合プラズマ工学

【Code】10C038 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Wed 3rd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	1	
	1	
	3	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Multiphase Flow Engineering and Its Application

混相流工学

【Code】10C037 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】KUNUGI, Tomoaki, YOKOMINE, Takehiko,

【Course Description】Reviewing of the fundamental definition and characteristics of multiphase flows, and to learn the governmental equations and some modelings of the constitutive equations and the current status of the multiphase flows. Moreover, to review and learn the fundamental definition and characteristics of particle flows, and to learn the numerical methods to track the particle laden flows and the particle measurement method.

【Grading】Present a summary of some papers regarding multiphase flows research by using a power point, and then answer several questions made by lecturers. The quality of your presentation and how deep understand your subject are the grading point.

【Course Goals】As for the multiphase flows, to learn its fluid dynamics behaviors, governing equations and numerical methods, and finally to discuss its applications to many engineering fields.

【Course Topics】

Theme	Class number of times	Description
What's the multiphase flows?	1	To review the definitions and fundamental characteristics of multiphase flows.
Governing equation of gas-liquid two phase flows	2	To learn the governing equation of gas-liquid two phase flows
Modeling of gas-liquid two phase flows	2	To learn modeling of gas-liquid two phase flows and its constitutive equations
Numerical methods	3	To learn the numerical methods to solve the single-phase and two-phase flows
Examples of gas-liquid two phase flow analysis	1	To show some examples of gas-liquid two phase flow analysis
Characteristics of particle flows	1	Review characteristics of particle flows
Fundamental aspect of particle flows	1	Explain variables and parameters subjected to interaction between particle and particle and/or particle and flow. Moreover, momentum and heat exchange between phases, i.e., to explain One-way, Two-way and Four-way coupling numerical methods.
Particle methods	2	Explain numerical method for thermofluid including static particles like a packed bed. Moreover, numerical methods for macroscopic and microscopic particles such as Discrete Element Method.
Measurements of particle characteristics	2	Review several measuring methods of particle characteristics and thermofluid behaviors

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Nonlinear Physics in Fusion Plasmas**

非線形プラズマ工学

【Code】 10R013 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 Atsushi Fukuyama,

【Course Description】 This course provides a comprehensive introduction to computational modeling and simulation of magnetically confined fusion plasmas. Topics include elements of nonlinear plasma physics, modeling of various phenomena in fusion plasmas, computational methods in plasma physics, and integrated simulation of fusion plasmas

【Grading】 Report in English

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Nonlinear Phenomena in Plasma Physics	1	Review of nonlinear phenomena in plasmas; modeling of plasmas
Nonlinear Waves in Plasmas	2	Nonlinear ion acoustic waves; Korteweg de Vries equation; Soliton; Nonlinear Schrodinger equation
Wave-Particle Interaction in Plasmas	2	Linear wave particle resonant interaction; Landau damping; Trapping in a single wave; Nonlinear interaction with waves; Stochastic particle motion; Quasi-linear interaction
Wave-Wave Interaction in Plasmas	2	Parametric instability; Three-wave interaction
Numerical Analysis of Differential Equations	4	Basics of numerical simulations; Ordinary differential equation; Partial differential equation; Matrix solver
Numerical Simulation of Fusion Plasmas	3	Numerical simulation of fusion plasmas: equilibrium, transport, heating and current drive, stability, energetic particles, integrated modeling
Assessment of Achievement	1	Assessment of Achievement

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】 Plasma Physics, Fundamental Magnetohydrodynamics, Fusion Plasma Physics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Bridge Engineering

## 橋梁工学

【Code】 10F010 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 3rd 【Location】 C1-172 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Hiromichi Shirato, Kunitomo Sugiura, Tomomi Yagi, Masahide Matsumura

【Course Description】 The subject matter of bridge engineering can be divided into two main parts, which are steel structure and wind loading/wind resistant structure. The aim of this course is to provide details of mechanical behaviors, maintenance and design of bridge structures. The former part of this course contains the static instability of steel structures and the problems of corrosion, fatigue, brittleness, weldability on steel bridges. In the latter part, the basics of wind engineering, bridge aerodynamics and wind-resistant design including current problems to be solved are provided.

【Grading】 Assessment will be based on exam, reports and participation.

### 【Course Goals】

Also, the basic knowledge for wind engineering and aerodynamic instabilities, which are necessary for the wind resistant design of bridges, will be acquired.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	- Fundamental knowledge on steel structures - Types of steel structures - Future trend of steel structures
Material behavior, Initial imperfections and Damages	1	- Construction of steel structures - Residual stresses and initial deformations - Damages
Stress-strain relationship, Joints	1	- Yield surfaces - Bauschinger effect - Hardening effect - Welded joint - Bolted joint
Fatigue fracture, fatigue life and fatigue design	1	- S-N design curve - Fatigue crack growth, stress intensity factor - Miner's rule on damage accumulation - Repair of fatigue damage
Structural stability and design for buckling	1	- Structural instability and accident - Theory of Stability - Compressive members, etc.
Corrosion and anti-corrosion of steel structures	1	- Mechanism of corrosion - Micro- and Macro- cells - Anti-corrosion - Life-cycle costs
Wind resistant design of structures	3	- Natural winds due to Typhoon, Tornado and so on - Evaluation and estimation of strong winds - Wind resistant design methods - Various kinds of design codes
Aerodynamic instabilities of structures	3	- Introduction of aerodynamic instabilities (ex. vortex-induced vibration, galloping, flutter, buffeting, cable vibrations) - Mechanisms of aerodynamic instabilities - Evaluation methods and Countermeasures
Wind-induced disaster	1	- Accidents on structures due to strong winds - Disaster prevention
Topics	1	Introduction of current topics on bridge engineering by a visiting lecturer
Confirmation of the attainment level of learning	1	Confirm the attainment level of learning

### 【Textbook】

### 【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for construction materials, structural mechanics and fluid mechanics are required.

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

## Structural Design

### 構造デザイン

【Code】 10F009 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd  
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English  
 【Instructor】 Yoshiaki Kubota, Yoshikazu Takahashi, Masahide Matsumura

【Course Description】 This course provides the knowledge of the structural planning and design for civil infrastructures. Fundamentals of the reliability of structures based on the probability and statistics are given. Emphasis is placed on the reliability index and the calibration of partial safety factors in the LRFD design format. Furthermore, the relationship between structure and form is discussed with various examples.

【Grading】 Assessed by term-end examination, reports and quizzes

【Course Goals】 To understand the structural planning and design for civil infrastructures.

To understand the reliability-based design of structures.

To deepen the understanding of the relationship between structure and form.

#### 【Course Topics】

Theme	Class number of times	Description
Structural Planning	2	Structural Planning of civil infrastructures is introduced. The concept, significance of planning, characteristics of civil infrastructures are discussed. Practical planning process of a bridge is explained.
Structure and Form	3	The bridge types such as girder, truss, arch and suspension bridge that have been regarded individually are explained as an integrated concept from the viewpoint of acting forces to understand the structural systems which have continuous or symmetrical relationships. Furthermore, various examples are discussed based on the understanding of the structural systems.
Structural Design and Performance-based Design	3	Design theory of civil infrastructures is introduced. The allowable stress design method and the limit state design method are explained. The basic of earthquake resistant design is discussed based on the dynamic response of structures. Performance-based design is also introduced.
Random Variables and Functions of Random Variables	1	Fundamentals of random variables, functions of random variables, probability of failure and reliability index in their simplest forms are lectured.
Structural Safety Analysis	3	Limit states, probability of failure, FOSM reliability index, Hasofer-Lind reliability index, Monte Carlo method are lectured.
Design Codes	2	Code format as Load and Resistance Factors Design (LRFD) method, calibration of partial safety factors based on the reliability method are given.
Assessment of the Level of Attainment	1	Assess the level of attainment.

【Textbook】 Reliability of Structures, A. S. Nowak & K. R. Collins, McGraw-Hill, 2000

【Textbook(supplemental)】 U.Baus, M.Schleich, "Footbridges", Birkhauser, 2008 ( Japanese ver.:

"Footbridges"(translated by Kubota, et al.), 鹿島出版会, 2011 )

久保田善明, 『橋のディテール図鑑』, 鹿島出版会, 2010

Other books will be given in the lectures as necessary.

【Prerequisite(s)】 Fundamental knowledge on Probability and Statistics, and Structural Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Structural planning and design will be given by Y. Takahashi, Structure and form by Y. Kubota, and Structural reliability analysis by M. Matsumura.

## Infrastructural Structure Engineering

社会基盤構造工学

【Code】 10W001 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Related Faculty members,

【Course Description】 Structural engineering problems related to planning, design, construction and maintenance of the infrastructures are discussed. Topics concerning structural engineering and management are widely taken up including latest advanced knowledge and technology, future view and/or international topics. Special lectures by extramural lecturers are carried out if necessary.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To grasp problems related to structural engineering and their specific solutions.  
To understand applicability of advanced technologies and development prospects.

### 【Course Topics】

Theme	Class number of times	Description
Structural Materials, Structural Mechanics	4	Steel materials, Concrete materials, mechanical behavior of structures, Problems related to design, construction and maintenance
Applied Mechanics	1	Numerical analysis for structure performance evaluation
Earthquake and Wind Resistance of Structures	7	Infrastructure and natural disaster, Trends of disaster prevention technology, Problems related to Earthquake and wind resistant design
Maintenance of structure	3	International technology, Scenario design, International technological education and collaboration

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Supplemental text books will be introduced by instructors.

【Prerequisite(s)】 Structural Mechanics, Wind Resistant Design, Construction Materials, Dynamics of Structures, etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics A**

応用力学特別演習 A

【Code】 10W005 【Course Year】 Doctor 1st 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics B**

応用力学特別演習 B

【Code】 10W007 【Course Year】 Doctor 1st 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics C**

応用力学特別演習 C

【Code】 10W009 【Course Year】 Doctor 2nd 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics D**

応用力学特別演習 D

【Code】 10W011 【Course Year】 Doctor 2nd 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics E**

応用力学特別演習 E

【Code】 10W013 【Course Year】 Doctor 3rd 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercise in Applied Mechanics F**

応用力学特別演習 F

【Code】 10W015 【Course Year】 Doctor 3rd 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship M**

インターンシップ M (応用力学)

【Code】 10W019 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship DS**

インターンシップ DS (応用力学)

【Code】 10W021 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship DL**

インターンシップ DL (応用力学)

【Code】 10W023 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 6 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar of Complex Mechanical Engineering,A**

複雑系機械工学セミナー A

【Code】 10V025 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 1st

【Location】 C3-Lecture Room 2 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Matsuno, Ide, Matsumoto, Takata, Suzuki,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at  
cme-seminar@me.kyoto-u.ac.jp

**Seminar of Complex Mechanical Engineering,B**

複雑系機械工学セミナー B

【Code】 10V027 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 1st

【Location】 C3-Lecture Room 2 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Matsuno, Ide, Matsumoto, Takata, Suzuki,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at  
cme-seminar@me.kyoto-u.ac.jp

**Seminar of Complex Mechanical Engineering,C**

複雑系機械工学セミナー C

【Code】 10V029 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 1st

【Location】 C3-Lecture Room 2 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Matsuno, Ide, Matsumoto, Takata, Suzuki,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at  
cme-seminar@me.kyoto-u.ac.jp

**Seminar of Complex Mechanical Engineering,D**

複雑系機械工学セミナーD

【Code】10V031 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Thu 1st

【Location】C3-Lecture Room 2 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Seminar

【Language】English 【Instructor】Matsuno, Ide, Matsumoto, Takata, Suzuki, Ikeda,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at  
cme-seminar@me.kyoto-u.ac.jp

**Seminar of Complex Mechanical Engineering,E**

複雑系機械工学セミナー E

【Code】 10V033 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 1st

【Location】 C3-Lecture Room 2 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Matsuno, Ide, Matsumoto, Takata, Suzuki,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at  
cme-seminar@me.kyoto-u.ac.jp

**Seminar of Complex Mechanical Engineering,F**

複雑系機械工学セミナー F

【Code】 10V035 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 1st

【Location】 Engineering Science Depts Bldg.-215 【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Matsuno, Ide, Matsumoto, Takata, Suzuki, Ikeda,

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

# Structural Testing Technology

## 構造工学実験法

【Code】 10W017 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Summer vacation period 【Location】 Structural testing laboratory

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Hiromichi SHIRATO, Kunitomo SUGIURA, et al.,

【Course Description】 The structural design method is going to shift to the performance based design. Since applications of new construction methods and new technology can be accelerated by the use of performance based design, it is necessary to evaluate the performance of structures by the material and structural tests. In this class, the various test methods under static and dynamic loading will be discussed including shaking table test, wind tunnel test and nondestructive evaluation. Instrumentation to measure strain, force, acceleration, temperature and other physical state variables is also discussed through the course work.

【Grading】 Grade is given based on attendance and reports.

【Course Goals】 To carry out the structural performance evaluation by material test and structural test based on fundamental understanding of measurement of strain, deflection and vibration in conjunction with the development of design methodology, computing technology, electronics and instrumentations.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Physical modeling in structural engineering -Modeling process -Modeling case studies
Dimensional analysis	1	Dimensional analysis for structural models -Similitude requirements(general) -Elastic model -Inelastic model
Instrumentation	2	Data acquisition -Strain -Displacement -Stress and Force -Acceleration -Temperature -Crack detection -Smart structures
Loading system	2	-Loading apparatus -Hydraulic system -Computer control -Loading techniques
Material test	3	-Universal testing machine -Fatigue testing machine -Stress vs. strain relation
Structural testing	3	-Static loading test -Hybrid loading test -Considerations in testing
Shaking table test	1	-Structural models for seismic loading -Similitude requirements -Considerations in shaking table test
Wind tunnel test	1	-Structural models for wind loading -Similitude requirements -Considerations in wind tunnel test
Nondestructive evaluation	1	-Strain measurement -Ultrasonic test -Magnetic particle test -Infrared test

### 【Textbook】

【Textbook(supplemental)】 introduced if necessary

【Prerequisite(s)】 Knowledge on construction materials, structural mechanics, structural dynamics, instrumentation engineering are required.

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

**Advanced Experiment and Exercise in Applied Mechanics I, II**

応用力学特別実験及び演習第一

【Code】 10V037 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Experiment and Exercise in Applied Mechanics I, II**

応用力学特別実験及び演習第二

【Code】 10V039 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Infrastructure Creation Engineering

社会基盤工学創生

【Code】 10F081 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th 【Location】 C1-192

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 related teaching staff,

【Course Description】 A system of scientific principles and technologies is required which enable to create safe, reliable and vigorous human society with enough world-wide competitiveness. The class of Infrastructure Creation Engineering will lecture ongoing, retrospective and perspective on global environment, fundamental science/engineering, social science, social economics and major scientific principles and technologies on natural environment including ecological system, which are needed to develop infrastructures.

【Grading】 Grading will be based on reports (70%) and evaluation in each class (30%).

【Course Goals】 It is aimed to make understand a system of scientific principles and technologies which is required to create human society with sustainable development and to indicate their concept clearly. Major contents to create infrastructure as well as fundamental knowledge on its retrospective and perspective will be able to be learned.

### 【Course Topics】

Theme	Class number of times	Description
Role of geotechnics in sustainable infrastructure creation	2	
Role of hydro mechanics and water engineering in infrastructure creation and its evaluation	2	
Planning for infrastructure creation	2	
Subjects in material and structural engineering in rebuilding of infrastructure	2	
Role of earth resources engineering for sustainable development in harmonious with environment	2	
Role of environmental engineering in infrastructure creation	2	
Thermal fluid dynamics for fundamental understanding of global environmental subjects	2	
Confirmation of educational achievement	1	

【Textbook】 None

【Textbook(supplemental)】 To be introduced at any time

【Prerequisite(s)】 It is desired to acquire basic knowledge on civil, environmental, earth resources and mechanical engineering.

【Independent Study Outside of Class】

【Web Sites】 None

【Additional Information】 To present in every class will be checked.

**Developmental and Sustainable Infrastructure Engineering Seminar A**

発展的持続性社会基盤工学セミナー A

【Code】 10W201 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Developmental and Sustainable Infrastructure Engineering Seminar B**

発展的持続性社会基盤工学セミナー B

【Code】 10W203 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Infrastructural Structure Engineering

社会基盤構造工学

【Code】 10W001 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Related Faculty members,

【Course Description】 Structural engineering problems related to planning, design, construction and maintenance of the infrastructures are discussed. Topics concerning structural engineering and management are widely taken up including latest advanced knowledge and technology, future view and/or international topics. Special lectures by extramural lecturers are carried out if necessary.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To grasp problems related to structural engineering and their specific solutions.  
To understand applicability of advanced technologies and development prospects.

### 【Course Topics】

Theme	Class number of times	Description
Structural Materials, Structural Mechanics	4	Steel materials, Concrete materials, mechanical behavior of structures, Problems related to design, construction and maintenance
Applied Mechanics	1	Numerical analysis for structure performance evaluation
Earthquake and Wind Resistance of Structures	7	Infrastructure and natural disaster, Trends of disaster prevention technology, Problems related to Earthquake and wind resistant design
Maintenance of structure	3	International technology, Scenario design, International technological education and collaboration

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Supplemental text books will be introduced by instructors.

【Prerequisite(s)】 Structural Mechanics, Wind Resistant Design, Construction Materials, Dynamics of Structures, etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Hydraulic Engineering for Infrastructure Development and Management

水域社会基盤学

【Code】10F065 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd  
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Hosoda Takashi, Toda Keiichi, Gotoh Hitoshi, Tachikawa Yasuto, Kishihida Kiyoshi, Ichikawa Yutaka,  
 Harada Eiji, Sanjou Michio, Khayyer Abbas and Kim Sunmin,

【Course Description】 This lecture picks up various water-related problems and provides their explanation and solution methodology related to hydrodynamic and hydrological infrastructure improvements, maintenance, disaster prevention against flood and damage of water environment, interweaving several leading-edge cases in the real world. Turbulent flow and CFD, sediment transport system and design/planning of hydraulic structure are described on the basis of the integrated management of river-and-coast systems with sediment control and these relationship with infrastructure improvement. Perspective from the viewpoint of public environmental infrastructure on water environment is presented.

【Grading】 Grading is based on students activities in lectures and reports.

【Course Goals】 Students learn about case-based practical solutions against various problems related to hydraulic engineering, and students acquire academic preparation of how to approach to public environmental infrastructure on water area.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Hydraulics in open-channel flows	3	Several problems and exciting topics related to hydraulics in open-channel flows are discussed with advanced practical examples.
River basin management	3	Introduction of flood disasters during a few decades in the world, flood control planning in Japan, Economic evaluation and analysis of people ' s awareness to river improvement projects with dam construction.
Beach erosion	3	Several problems and their solution methodology against sediment transport process in coastal zone are explained. Advanced approaches for sediment control are overviewed.
Rainfall-runoff prediction and hydrologic design	3	Water resources issues related to rainfall-runoff prediction and hydrologic design are discussed with advanced practical examples.
Numerical simulation for Hydraulic engineering	1	Recent numerical simulation development and related state-of-the-art technologies are overviewed.
Achievement Confirmation	1	Comprehension check of course contents.The exercises to the given subjects are performed.

【Textbook】 Non

【Textbook(supplemental)】 Non

【Prerequisite(s)】 hydraulics, fluid mechanics, river engineering, coastal engineering, hydrology, etc.

【Independent Study Outside of Class】

【Web Sites】 Non

【Additional Information】 Non

## Resources Development Systems

資源開発システム工学

【Code】 10A402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st  
 【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese  
 【Instructor】 S. Murata,

【Course Description】 Development of mineral resources and energy resources is essential to the sustainable development of our society. In this class, the exploration and development process of natural resources are reviewed including the problems of environmental conservation. In addition, petrophysics and its application to the resources exploration and fundamentals of reservoir engineering used for evaluating the production behavior and reserves of oil and natural gas are lectured.

【Grading】 Evaluation is made by the average score of the report problems presented by each teacher.

【Course Goals】 The goal of this class is to master the fundamentals of petrophysics and reservoir engineering needed for the exploration and development of oil and natural gas resources.

### 【Course Topics】

Theme	Class number of times	Description
From exploration to development of natural resources	1	The exploration and development process of mineral resources and energy resources, which are essential to the sustainable development of our society, is reviewed including the environmental conservation.
Petrophysics used in natural resources development	2	To know the elastic properties of sedimentary rocks is essential when we consider the exploration and development of oil and natural gas resources. For the sedimentary rocks, physical variables, a rule of thumb and the pore fluid that affect the elastic wave velocity are mainly lectured. For igneous rocks, in addition, the rule of thumb on the physical properties of the rocks affected by fractures are lectures, because fractures in the rocks defines their physical properties.
Fundamentals of reservoir engineering	3	The properties of reservoir fluids and the material balance method to evaluate the reserve of oil and natural gas are explained.
Fluid flow in the reservoir	7	Basic equations of fluid flow in the reservoir and the analytical solution for the flow of oil and natural gas around a well are explained, and the concept and the method of well test analysis are also explained.
Enhanced oil and natural gas recovery	2	The methods of enhanced oil and natural gas recovery (EOGR) are overviewed. The essentials of each EOGR method are explained.

【Textbook】 Handouts are delivered.

【Textbook(supplemental)】 L.P.Dake, Fundamentals of Reservoir Engineering, Developments in petroleum science Vol.8, Elsevir, ISBN 0-444-41830-X

G.Mavko, T. Mukerji and J. Dvorkin, The rock physics handbook :tools for seismic analysis in porous media, Cambridge University Press, ISBN 0-521-62068-6

【Prerequisite(s)】 It is desirable to have knowledge of calculus at the undergraduate level

【Independent Study Outside of Class】

【Web Sites】 Web page of this lecture is not specifically provided. When preparing it by need, the information is shown in the class.

【Additional Information】 Not specified

## Environmental Risk Analysis

### 環境リスク学

【Code】10F439 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Yoneda, Takano, Matsuda, Shimada, Matsui,

【Course Description】Paying attention to the environment of children in particular, students themselves study, make presentation, and debate about the environmental risk. Students learn the background, the actual situation, and the theory for quantitative risk analysis through practice of investigation and discussion by themselves.

【Grading】Grading based on the participation and performance in presentation and discussion.

【Course Goals】To understand or master the necessity of environmental risk analysis, its practical examples, framework for solving problems concerning to risk evaluation, technical and basic knowledge for environmental risk analysis, and the way of thinking for risk analysis

#### 【Course Topics】

Theme	Class number of times	Description
Introduction		
Framework of risk analysis	2	Introduction of lecture and grading. Framework of risk analysis for children of WHO.
Children and health risk	1	1) Why children 2) Children are not little adults
Children and environmental change	1	3) The paediatric environmental and health history 4) Global change and children
Air pollution	1	5) Outdoor air pollution 6) Indoor air pollution
Lead and pesticide	1	7) Pesticides 8) Lead
Heavy metal	1	9) Mercury 10) Other heavy metals
Various risk	1	11) Noise 12) Water 13) Food safety
Chemicals	1	14) Children and chemicals 15) Persistent Organic Pollutants
Tobacco and natural toxin	1	16) Second-hand tobacco smoke 17) Mycotoxins, plants, fungi and derivatives
Occupational risk and radiation	1	18) Injuries 19) Ionizing and non-ionizing radiations 20) Occupational risks
Respiratory diseases and cancer	1	21) Respiratory diseases 22) Childhood cancer
Innume disorders and neural system	1	23) Immune disorders 24) Neurobehavioral and neurodevelopmental disorders
Endocrine system and environmental monitoring	1	25) Endocrine disorders 26) Bio-monitoring and environmental monitoring
D evelopmental toxicity and indicators	1	27) Early developmental and environmental origins of disease 28) Indicators

【Textbook】Necessary files are supplied.

【Textbook(supplemental)】To be introduced if necessary.

【Prerequisite(s)】Not necessary in particular.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】The contents may be changed according to the progress of lecture.

**Optimum System Design Engineering**

最適システム設計論

【Code】 10G403 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	5	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Developmental and Sustainable Infrastructure Internship A**

発展的持続性社会基盤工学 ORT・インターンシップ A

【Code】 10W209 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 5th

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Developmental and Sustainable Infrastructure Internship B**

発展的持続性社会基盤工学 ORT・インターンシップ B

【Code】 10W211 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 5th

【Location】 C1-117 【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Developmental and Sustainable Infrastructure Engineering Seminar I**

発展的持続性社会基盤工学演習

【Code】 10W213 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Developmental and Sustainable Infrastructure Engineering Seminar II**

発展の持続性社会基盤工学演習 II

【Code】 10W215 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Continuum Mechanics

連続体力学

【Code】 10F003 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Kunitomo Sugiura, Tomomi Yagi,

【Course Description】 Continuum mechanics is a unified basis for solid mechanics and fluid mechanics. The aims of this course are to introduce the continuum mechanics from their basics to the some forms of constitutive law and also to provide students with mathematical way of understanding the continuum mechanics. This course contains the fundamentals of vector and tensor calculus, the basic equations of continuum mechanics, the tensor expressions of elastic problems and further applications.

【Grading】 Assessment will be based on exam, report and participation.

【Course Goals】 Fundamental theorems on structural mechanics and design will be learned, and ability to judge the proprieties of each computational structural analysis will be acquired.

### 【Course Topics】

Theme	Class number of times	Description
Introductions	1	
Matrices and tensors	1	
differential and integral calculus of tensors	1	
Kinematics	1	- Material derivative
Deformation and strain	2	- Strain tensors - Compatibility conditions
Stress and equilibrium equation	1	
Conservation law and governing equation	1	
Constitutive equation of idealized material	1	
Elastic-plastic behavior and constitutive equation of construction materials	1	
Boundary value problem	1	
Variational principle	1	
Various kinds of numerical analyses	2	
Confirmation of the attainment level of learning	1	

### 【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for structural mechanics, soil mechanics and fluid mechanics are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Structural Stability

構造安定論

【Code】 10F067 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd  
 【Location】 C1-171 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English  
 【Instructor】 Hiromichi SHIRATO, Kunitomo SUGIURA,

【Course Description】 Fundamental concept of static and dynamic stability of large-scale structures such as bridges is to be introduced in addition to the way to keep/improve their safety and to evaluate their performance. Basic concept of structural stability and its application and technical subjects to improve safety will be lectured systematically. Furthermore, the practical solutions to the subjects are to be introduced to assure the safety of structures.

【Grading】 Grading will be evaluated by written examination, reports and attendance.

【Course Goals】 The class aims to cultivate the understanding of static and dynamic stability problems for structural system and make understand the methodology to clarify the limit state. To get knowledge on countermeasures to assure the stability which is applicable to practical design and manufacturing will be also required.

### 【Course Topics】

Theme	Class number of times	Description
Elastic Stability under Static Loading	7	Stability of Structures and Failures Basis of Structural Stability Elastic Buckling of Columns Elastic Buckling of Beams & Frames Elastic Buckling of Plates Elasto-plastic Buckling Buckling Analysis
Basic theory of dynamic stability and its application	7	The stability around the equilibrium points based on the state equation of motion in which the nonlinearity of external, damping and restrung forces are taken into account. Wind-induced vibration of a square prism (Galopping) and 1dof system with nonlinear spring will be introduced as practical examples. Chaotic motion of a pendulum subjected to periodic external force is also explained as an introduction of chaos theory.
Achievement Check	1	Summary and Achievement Check.

【Textbook】 Not specified.

【Textbook(supplemental)】 Introduced in class if necessary.

【Prerequisite(s)】 It is desired for participants to master structural mechanics, continuum mechanics, mathematical analysis as well as vibration theory.

【Independent Study Outside of Class】

【Web Sites】 none

【Additional Information】 none

## Material and Structural System & Management

材料・構造マネジメント論

【Code】 10F068 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Hirotaka Kawano, Atsushi Hattori, Takashi Yamamoto,

【Course Description】 With regard to the maintenance of concrete structures, the deterioration prediction procedures in material and structural properties are discussed based on durability and deterioration processes of concrete structures. Repair materials and methods are also introduced. Note: strengthening materials and methods are discussed in Concrete Structural Engineering, provided in the second semester. In the later half of this lecture, structures are focused as groups rather than an individual structure to understand the difference between asset management and maintenance. By taking into consideration the economic aspect and human resources aspect as well as the physical aspect, the flow of the asset management for structures' groups with view points of the life cycle cost and the budget is provided.

【Grading】 Reports ,presentations and other activities are inclusively considered.

【Course Goals】 To understand the maintenance for a single structure and the asset management for structures' group.

### 【Course Topics】

Theme	Class number of times	Description
1. Outline of maintenance for concrete structures	1	
2. Deterioration mechanisms of concrete structures and deterioration prediction	4	
3. Repair materials and methods for concrete structures	1	
4. Maintenance and asset management	2	
5. Maintenance for structures' group	2	
6. Management for structures' group	2	
7. Presentations and discussions	3	

【Textbook】 Not specified. Some materials may be provided.

【Textbook(supplemental)】 Not specified.

【Prerequisite(s)】 Basic knowledge on Construction Materials and Concrete Engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Positive presence in the lecture is expected by joining discussions for example.

## Computational Fluid Dynamics

数值流体力学

【Code】 10F011 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Satoru Ushijima, Hitoshi Gotoh, Abbas Khayyer,

【Course Description】 Computational Fluid Dynamics (CFD) is largely developed according to the progress of computer technology in recent years. It is the powerful and effective technique to predict the various fluid phenomena, which show the complicated behaviors due to the non-linearity and other conditions. This course provides the dynamics of fluids and eddies as well as the discretization and numerical techniques, such as finite difference, finite volume and particle methods.

【Grading】 The grading will be based on homework assignments.

【Course Goals】 Course goal is to understand the basic theory and numerical techniques for CFD.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of recent examples of CFD
computational method for incompressible fluids	7	The course introduces the MAC algorithm, which is generally used for incompressible Newtonian fluids on the basis of finite difference and finite volume methods (FDM and FVM). The outline of numerical methods is also discussed for parabolic, hyperbolic or elliptic partial differential equations, in terms of the numerical stability and accuracy. Homework will be assigned each week.
Particle method - basic theory and improvements	7	To simulate violent flow with gas-liquid interface which is characterized by fragmentation and coalescence of fluid, particle method shows excellent performance. Firstly, basics of the particle method, namely discretization and algorithm, which is common to SPH(Smoothed Particle Hydrodynamics) and MPS(Moving Particle Semi-implicit) methods, are explained. Particle method is superior in robustness for tracking complicated interface behavior, while it suffers from existence of unphysical fluctuation of pressure. By revisiting the calculation principle of particle method, various improvements have been proposed in recent years. In this lecture, the state-of-the-art of accurate particle method is also described.

【Textbook】 No textbook assigned to the course

【Textbook(supplemental)】 Recommended books and papers will be introduced in the course.

【Prerequisite(s)】 Basic knowledge of fluid dynamics, continuum mechanics and computational technique

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Structural Dynamics

### 構造ダイナミクス

【Code】10F227 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 1st  
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】Igarashi, Furukawa

【Course Description】 This course deals with dynamics of structural systems and related topics, to provide the theoretical basis to deal with the problems of vibration, safety under dynamic loads and health monitoring associated with infrastructures. The students will study the dynamic response, properties of natural modes and methods of eigenvalue analysis for multi-DOF systems. The topics on the numerical time integration schemes, probabilistic evaluation of structural response to random excitation, and dynamic response control techniques for structures are also studied.

【Grading】 Based on the results of a final examination, plus homework assignments

【Course Goals】 (1) To acquire the knowledge on theories and principles of analysis of MDOF systems (2)

Systematic understanding of frequency-domain structural response analysis (3) Concept of analysis of numerical time integration schemes (4) Understanding of fundamentals of the random vibration theory

#### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Fudamental concepts, harmonic motion
Dynamics of Multi-Degree-Of-Freedom Systems	2	Formulation of Eq. of Motion / Lagrange's method / Normal Modes / Modal Analysis / Modeling of System Damping
Frequency-Domain Analysis of System Response	1	Frequency Response Funcs. / Fourier Transform
Numerical Time Integration	2	Formulation / Stability and Accuracy Analysis of Integration
Random Vibration	6	Overview / Probability Theory / Sequence of i.i.d. Random Variables / Concept of Random Processes / Correlation Funcs. / White Noise / Stochastic Differential Eq. / Lyapunov Eq. / Response to White Noise Excitation / Covariance Matrix Approach / Correlation Funcs. of Random Response / Spectral Representation of Random Processes / Spectral Representation of Structural Response / Application
Structural Response Control	2	Active Control / Semi-Active Control
Achievement Evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Mechanical vibration (undergraduate level), Complex calculus (integration of analytic functions, Fourier transform, etc.), Probability theory, Linear algebra

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There will be homework assignments at the end of most of the lectures.

**Earthquake Engineering/Lifeline Engineering**

地震・ライフライン工学

【Code】 10F261 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 4th

【Location】 C1-191 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Kiyono,Igarashi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
Principles of seismic design of structures	2	Fundamental theories on dynamic response of nonlinear elastoplastic structural systems and representative seismic design principles
Seismic performance of concrete and steel structures	1	Essentials and current issues related to seismic performance and design of RC and steel structures
Seismic response control and seismic retrofit of structures	1	Idea and current issues on seismic isolation, seismic response control techniques for enhancement of seismic performance of structures, and seismic retrofit and rehabilitation of existing structures
	1	
	2	
	1	
	1	
Achievement evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Seismic Engineering Exercise

サイスマックシミュレーション

【Code】 10F263 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and Exercise

【Language】 Japanese 【Instructor】 Sawada, Takahashi,

【Course Description】 This course provides the knowledge of simulation methods for earthquake engineering.

Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the response analysis of structure selected by themselves considering soil-structure interaction.

【Grading】 Based on the performance during the course (including homework) and the results of presentation and reports.

【Course Goals】 At the end of this course, students will be required to have a good understanding of: - Prediction of ground motion generated by a specified seismic fault - Dynamic response analysis of structures and foundation (linear/nonlinear)

### 【Course Topics】

Theme	Class number of times	Description
Frequency domain analysis	1	Basics of Fourier transformation is introduced.
Modeling of structure - soil system and time domain analysis	1	Equation of motion of SR model is introduced and the integration method of the equation in time domain is explained.
Exercise of linear seismic response analysis	2	Small groups of students are exercised in elastic modeling of structures and linear response analysis in time domain and frequency domain.
Prediction of ground motion by empirical Green's function method	3	Empirical Green's function method is introduced to predict large earthquakes based on observed small earthquakes.
Seismic analysis method of soil	2	Seismic analysis method of layered half-space based on equivalent linearization method is introduced.
Nonlinear seismic analysis method of structures	2	Nonlinear modeling of structures and the integration and iterative methods of the nonlinear equation of motion in time domain are introduced.
Exercise of nonlinear seismic response analysis	3	Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the nonlinear response analysis of structures and foundation.
	1	

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Earthquake Engineering/Lifeline Engineering (10F261), Structural Dynamics (10F227)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Hydraulics & Turbulence Mechanics**

水理乱流力学

【Code】10F075 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 3rd

【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Toda,Sanjou,Okamoto,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance and entrance level lecture about fluid dynamics and turbulence
Theories of turbulence	3	Lectures about momentum equation, boundary layer, energy transport, vortex dynamics and spectrum analysis
Turbulence in natural rivers	4	Lectures about diffusion and dispersion phenomena observed in natural rivers.
Vegetation and turbulence	3	Lecture about turbulence transport in vegetation canopy together with introduction of recent researches
Practical topics in natural rivers	2	Lectures about compound channel and sediment transport
Practical topics in hydraulic engineering	2	Lectures about drifting object in flood and fish way

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Basin Environmental Disaster Mitigation**

流域環境防災学

【Code】 10F466 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 3rd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## River basin management of flood and sediment

流域治水砂防学

【Code】10F077 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 1st

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】(DPRI) Nakagawa, H., (DPRI) Sumi, T., (DPRI) Takebayashi, H. and (DPRI) Kawaike, K.,

【Course Description】In a river basin, various kinds of disasters such as debris flow, land slide, flood inundation, storm surge, and etc. sometimes happen from the origin to the mouth. This lecture presents occurrence examples, mechanisms, theory and methods of prediction and prevention/mitigation methods against those disasters. Also this lecture mentions comprehensive management in a sediment routing system focusing on sediment management strategy in dam reservoirs.

【Grading】Grading is based on 2 reports out of 4 topics and attendance.

【Course Goals】The goals of the class are to understand phenomena within a river basin and to have wide knowledge of problems of flood and sediment disasters and countermeasures against them.

### 【Course Topics】

Theme	Class number of times	Description
About Sabo Works	4	About Sabo works, sediment disasters, countermeasures against sediment disasters, Sabo projects.
About Reservoir Sediment Management	3	Reservoir sediment management focusing on reservoir sustainability and comprehensive management in a sediment routing system is overviewed including worldwide perspective and Japanese advanced case studies.
About basin-wide sediment routing	4	About the one dimensional bed deformation analysis and the sediment runoff model are introduced. Furthermore, some examples of the application of those models are introduced.
About basin-wide flood management	4	Flood disasters and countermeasures against them are overviewed along the history of flood management in Japan.

【Textbook】No designation. Printed materials regarding the contents of this class are distributed in class.

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Fundamental knowledge of Hydraulics and river engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This class is held biennially and is not held in 2014. Attendance is taken every time.

## River Engineering and River Basin Management

河川マネジメント工学

【Code】 10F019 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 1st 【Location】 C1-173

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Hosoda, Kishida, Onda

【Course Description】 It is important to consider about rivers comprehensively in view of the various aspects based on natural science and engineering. The fundamental knowledge to consider rivers and make the plans of river basins is explained with the following contents: various view points to consider rivers, long term environmental changes of rivers and its main factors, river flows and river channel processes, ecological system of rivers and lakes, flood disasters, integrated river basin planning(flood defense, environmental improvement planning, sediment transport system), functions of dam reservoir and management to learn the fundamental knowledge and grounding to consider rivers from the various points of view such as natural science, engineering and social science.

【Grading】 Reports, Attendance

【Course Goals】 The fundamental knowledge which can consider a river with various senses from a viewpoint of natural science, an engineering viewpoint and a social-scientific viewpoint, is mastered.

【Course Topics】

Theme	Class number of times	Description
Various view points on rivers and river basins	1	Various viewpoints and river basins, Various rivers on the earth, Formation processes of river basins, long term environmental changes of rivers and its main factors
Ecological system in rivers	2	Fundamental knowledge on river eco-system
Application of computational methods to environmental problems	2	Numerical analysis of the environmental change in Lake Biwa, Flood flows and river channel processes, sediment transport and bed deformation in rivers
Recent flood disasters & Integrated river basin planning	2	Characteristics of recent flood disasters, River law, Fundamental river management plan, River improvement plan, Procedures of flood defense planning, Flood invasion analysis and hazard map
Groundwater and its related field	2	Simulation technology of groundwater, Geo environmental issues, Reservoir Engineering, Contaminant Transport Processes
Sustainable development of dam	2	Needs of dam development and history of dam construction. Maintenance of Dam reservoir
Economic evaluation of environmental improvement projects	1	Evaluation of people's consciousness for river improvement works by means of CVM, Conjoint Analysis, etc.
Dam structure and maintenance	2	Dam structure, foundation, grouting. Design of Arch Dam and Gravity Dam.
Achievement Confirmation and Feedback	1	Comprehension check of course contents (Report)

【Textbook】 Printed materials regarding the contents of this class are distributed in class.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental knowledge of Hydraulics, Hydrology and Ecology

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Students can contact with professors by visiting their rooms and sending e-mail.

Prof. Hosoda: hosoda.takashi.4w@kyoto-u.ac.jp

Assoc. Prof. Kishida: kishida.kiyoshi.3r@kyoto-u.ac.jp

Assistant. Prof. Onda: onda.shinichiro.2e@kyoto-u.ac.jp

## Sediment Hydraulics

流砂水理学

【Code】10A040 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd  
 【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】Hitoshi Gotoh and Eiji Harada,

【Course Description】Natural flows in river and coast are movable bed phenomena with the interaction of flow and sediment. At a river and a coast, a current and a wave activate a sediment transport and bring the topographical change of a bed such as sedimentation or erosion. This lecture provides an outline about the basics of sediment (or movable bed) hydraulics, and detail of the computational mechanics of sediment transport, which has been developed on the basis of dynamics of flow and sediment by introducing a multiphase flow model and a granular material model. Furthermore, about sediment and water-environment relationship, some of frontier technologies, such as an artificial flood, removal works of dam sedimentation, coastal protection works, and sand upwelling work for covering contaminated sludge on flow bottom etc., are mentioned.

【Grading】Grading is based on student ' s activities in lectures and written examination.

【Course Goals】Students understand the basics of sediment hydraulics and outline of advanced models for computational sediment hydraulics, such as multiphase flow model and granular material model. Students understand the present conditions of sediment control works.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Basics of sediment hydraulics	5	Physical characteristic of a movable bed and a non-equilibrium sediment transport process and its description are explained. Furthermore, the prediction technique of topographical change due to current and waves is outlined.
Computational mechanics of sediment transport: The state of the art	8	Essential parts of numerical models of the movable bed phenomena, which has been developed by introducing dynamic models such as a granular material model to describe a collision of sediment particles and a multiphase flow model to describe a fluid-sediment interaction, are described. In comparison with the conventional movable bed computation, the points on which has been improved to enhance the applicability of the models are concretely mentioned. Some frontier studies of sediment transport mechanics are also introduced.
Achievement confirmation	1	Comprehension check of course contents.

【Textbook】Hitoshi Gotoh: Computational Mechanics of Sediment Transport, Morikita Shuppan Co., Ltd., p.223, 2004 (in Japanese).

【Textbook(supplemental)】Non

【Prerequisite(s)】Undergraduate-level Hydraulics or Hydrodynamics is required. Because a commentary easy as possible is kept in mind by lectures, students without these prerequisite are welcomed.

【Independent Study Outside of Class】

【Web Sites】Non

【Additional Information】Non

## Coastal Wave Dynamics

海岸波動論

【Code】10F462 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 3rd  
 【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Hitoshi Gotoh , Khayyer Abbas, Eiji Harada and Hiroyuki Ikari

【Course Description】Wave motion, which is the main driving force in coastal zone, is explained focusing on wave transformation theory and computational fluid dynamics, and design for coastal structures of their engineering applications is illustrated. As for the computational fluid dynamics for waves, methodology of free-surface wave based on the Navier-Stokes equation, which has been significantly developed in recent years, is explained in detail.

【Grading】Grading is based on student ' s activities in lectures and written examination.

【Course Goals】Goal of this course is a detailed understanding of fundamental of wave transformation theory and computational fluid dynamics related to wave motion, and is also acquiring a design concept for coastal structures as their engineering applications.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture the method of the scholastic evaluation are explained.
Conservation laws of fluid	4	Fundamentals of fluid mechanics, liner / non-liner wave theories and numerical mathematics are explained.
Modeling of surf zone dynamics	6	Several methodologies against free-surface wave including breaking waves (i.e. VOF, MPS, SPH) are illustrated. Especially advanced approaches of MPS and SPH are explained in detail.
Introduction of turbulence models	1	Reynolds averaging models and large eddy simulation are outlined.
Modeling of rock mound dynamics	2	Method for tracking of armor blocks under high waves using Distinct Element Method is described.
Achievement Confirmation	1	Comprehension check of course contents.

【Textbook】Computational Wave Dynamics by Hitoshi Gotoh, Akio Okayasu and Yasunori Watanabe 234pp, ISBN: 978-981-4449-70-0

【Textbook(supplemental)】Non

【Prerequisite(s)】Non. It is desirable to have knowledge about hydraulics, fluid mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】If there are any questions, please send e-mail to the staff. This course will be offered in 2015.

**Hydrology**

水文学

【Code】 10A216 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 2nd  
 【Location】 C1-117 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English  
 【Instructor】 Yasuto TACHIKAWA and Yutaka ICHIKAWA

【Course Description】 Physical mechanisms of the hydrologic cycle are described from the engineering viewpoint. The rainfall-runoff modeling and its prediction method are emphasized. Physical hydrological processes explored are surface flow, saturated-unsaturated subsurface flow, streamflow routing, and evapotranspiration. Physical mechanism of each hydrological process and its numerical modeling method are explained. The basic equations and numerical simulation methods are provided. Then, detail of distributed hydrological modeling is explained through exercise.

【Grading】 Examination and report

【Course Goals】 The goals of the class are to understand the physical mechanism of hydrological processes, their basic equations, and numerical simulation methods.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Introduction	1	The hydrologic cycle and the hydrological processes are explained.
Surfaceflow	2	The physical process of the surface flow and its numerical modeling method are described. The basic equations of the surface flow and the numerical simulation methods are explained.
Streamflow routing	2	The physical process of the streamflow routing and its numerical modeling method are described. The basic equations of the streamflow routing and the numerical simulation methods are explained.
Channel network and watershed modeling	1	Numerical representations of channel networks and catchments are explained.
Distributed hydrological model	5	A physically-based distributed hydrological model is described, which is constructed with numerical representations of channel networks and catchments.
Climate change and hydrologic cycle	1	Data analysis of the latest GCM simulation is presented and the impact of climate change on the hydrologic cycle is discussed.
Evapotranspiration	2	The physical process of the evapotranspiration and its numerical modeling method are described. The basic equations of the evapotranspiration and the numerical simulation methods are explained.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】 Handouts are distributed at each class.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of hydraulics and hydrology

【Independent Study Outside of Class】

【Web Sites】 <http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】 This course is open in English every other year. In 2015, the course is not open.

## Hydrologic Design and Management

水工計画学

【Code】10F464 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 2nd  
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】Yasuto TACHIKAWA and Yutaka ICHIKAWA

【Course Description】Hydrologic design and real-time rainfall-runoff prediction methods are described. The frequency analysis of hydrologic extreme values and the time series analysis of hydrologic variables are described, and then a procedure to determine an external force for the hydrologic design are explained. Next, a physically based hydrologic model which includes various processes of human activities for the hydrologic cycle is described. A flood control planning and water resources management with the use of innovative hydrologic simulation tools is described. Then, A real-time rainfall runoff prediction method with the use of Kalman filter theory is described.

【Grading】Final report (100)

【Course Goals】The class aims to understand the probabilistic and statistical analysis of hydrologic variables to determine the external force of hydrologic designs, applications of hydrologic simulations for hydrologic designs, and real-time rainfall and runoff prediction methods for water resources management.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	A flood control planning and water resources planning are introduced.
Frequency analysis and hydrologic design	3	The frequency analysis of hydrologic extreme values is described. The methods to set the external force for the hydrologic design are explained.
Time series analysis and hydrologic design	2	The time series analysis of hydrologic variables is described. The methods to develop time series models, time series data generation methods, spatiotemporal variation of hydrologic variables and a random field model, disaggregation methods are explained.
Hydrologic modeling and predictive uncertainty	2	Hydrologic models which include the process of human activities for the hydrologic cycle is described. Then, hydrologic predictive uncertainty is explained, which is inevitable coming from model structure uncertainty, parameter identification uncertainty and model input uncertainty. Especially, the relation between spatiotemporal scales of hydrologic modeling and model parameter values is described.
Hydrologic modeling system	2	A hydrologic modeling system which helps to develop complicated hydrologic simulation models and its importance for a flood control planning is also described.
Watershed management for flood disaster	2	Watershed management to mitigate flood disasters is described. A cost-benefit analysis of flood control measures is discussed.
Real-time rainfall runoff prediction	2	A real-time rainfall runoff prediction method with the use of Kalman filter theory and a new filter theory is described.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge of hydrology, probability and statistics are required.

【Independent Study Outside of Class】

【Web Sites】<http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】

## Water Resources Systems

水資源システム論

【Code】 10A222 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st  
 【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese  
 【Instructor】 Hori, T.(DPTI) and Tanaka, K.(DPRI),

【Course Description】 Systems approach to natural and social phenomena associated to water resources is introduced in terms of planning and design of sustainable water resources systems.

【Grading】 Grading is done based on examination and commitment to classes.

【Course Goals】 Deep understanding of fundamentals for systems modeling of water-related natural and social processes and ability to perform data collection, analyses and design of sustainable water management systems.

### 【Course Topics】

Theme	Class number of times	Description
Optimum design of water resources systems	3	
decision support for water resources management	3	
Recent topics on water management	1	
Water management practices in the world	3	
Land surface model and its application to water management	4	
achievement check	1	

【Textbook】 Not specified.

【Textbook(supplemental)】 Supplemental documents will be introduced in classes.

【Prerequisite(s)】 Fundamentals of hydrology and water resources engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Open every two years. Available in 2015.

**Coastal and Urban Water Disasters Engineering**

沿岸・都市防災工学

【Code】 10F269 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 H. Mase,A. Igarashi,N. Yoneyama,Nobuhito Mori,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Out line of coastal and urbarn disasters	1	Introduction of coastal and urban disasters will be lectured. The type and cause of coastal and urban disasters will be explained for sequential lectures.
Modeling of tsunami, storm surge and waves	3	The fundamental physics and governing equations of tsunami, storm surge and ocean waves will be described and applications and historical events will be explained in detail.
Reduction of coastal disasters	3	Characteristics of historical tsunamis, storms surges and coastal erosion will be presented with countermeasures by engineering approaches. Reliability design for coastal structures will be explained following Japanese standard.
Earthquake Disaster in Urban Areas	1	Review of recent earthquake disasters in urban areas in Japan and other counries
Principle of Strucural Design against Disasters	3	Fundamental Principles of safety and performance of structures against extreme events, including earthquakes and tsunami
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Hydro-Meteorologically Based Disaster Prevention**

水文気象防災学

【Code】10F267 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Mon 3rd

【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kaoru Takara, Eiichi Nakakita, Takahiro Sayama

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	2	
	2	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Water Quality Engineering**

水環境工学

【Code】10F441 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 2nd

【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroaki TANAKA,Fumitake NISHIMURA,Naoyuki YAMASHITA,Makoto YASOJIMA,Sei-ichiro OKAMOTO

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	5	
	5	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Open Channel Hydraulics

開水路の水理学

【Code】 10F245 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 HOSODA, Takashi and ONDA, Shinichiro This class is not offered in 2015.

【Course Description】 Fundamental theory of Open Channel Hydraulics used in River Engineering and Urban Fluid

Engineering Fields are lectured, showing various applications in Hydraulic Engineering Field. The contents include the

following items: Application of singular point theory to water surface profile analysis, Derivation of 2-D depth averaged flow model, 1-D analysis of unsteady open channel flows, Plane 2-D analysis of steady high velocity flows, Plane 2-D analysis of unsteady flows, Higher order theory, etc.

【Grading】 Regular examination

【Course Goals】 The objective of this subject is to understand the grounds of Open Channel Hydraulics and to learn how to apply Open Channel Hydraulics to practical problems in hydraulic engineering field.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	The contents of this subject are introduced, overviewing the whole framework of Open Channel Hydraulics with various theoretical and computational results.
Derivation of 2-D depth averaged model	1	Derivation procedures of plane 2-D depth averaged model are explained in detail
Application of singular point theory to water surface profile analysis	1	The application of singular point theory to water surface profile analysis is explained.
1-D analysis of unsteady open channel flows	3	Fundamental characteristics of 1-D unsteady open channel flows, Method of Characteristics, Dam break flows, Computational methods for shallow water equations
Fundamentals of numerical simulation	1	Considering the convective equation as a basic example, the fundamental knowledge of numerical simulation is explained by means of finite difference method, finite element method, etc. Applications of these method to unsteady open channel flow equations are also shown with some practical applications.
Plane 2-D analysis of steady high velocity flows	1	Characteristics of steady plane 2-D flows are explained based on the method of characteristics.
Plane 2-D analysis of unsteady flows	3	Propagation of characteristic surface, shear layer instability, application of a generalized curvilinear coordinate to river flow computation, application of a moving coordinate system, etc.
Higher order theory	3	Boussinesq equation with the effect of vertical acceleration, full/partially full pressurized flow observed in sewer network, traffic flow analysis by means of dynamic wave model
Achievement Confirmation & Feedback	1	Understanding of the contents on Open Channel Hydraulics is confirmed. Students can send e-mail to ask the answers to the questions related to Open Channel Hydraulics.

【Textbook】 Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of fluid dynamics and hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Students can contact with Hosoda by sending e-mail to hosoda.takashi.4w@kyoto-u.ac.jp This class is not offered in 2015.

**Applied Hydrology**

応用水文学

**【Code】** 10F100 **【Course Year】** Master and Doctor Course **【Term】** 1st term **【Class day & Period】** Wed 4th**【Location】** C1-172 **【Credits】** 2 **【Restriction】** No Restriction **【Lecture Form(s)】** Lecture **【Language】** English**【Instructor】** Tomoharu Hori, Tetsuya Sumi, Shigenobu Tanaka, Yasuhiro Takemon, Kenji Tanaka, Sameh Kantoush**【Course Description】** Applied and integrated approach to the problems closely related to the water circulation system, such as floods, droughts, water contamination, ecological change, and social change is introduced mainly from the hydrological viewpoint with reference to water quantity, quality, ecological and socio-economic aspects. In the course, several actual water problems are taken up and solving process of each problem which comprises of problem-identification and formulation, impact assessment, countermeasures design and performance evaluation is learned through the lectures' description and also investigation and discussion among the students.**【Grading】** Grading is based on student activities in lectures, presentation and reports**【Course Goals】** To obtain fundamental Knowledge and skills to perform problem definition, survey and countermeasure design on problems about water use, water hazard mitigation and water environment.**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Water disasters and risk management	2	Risk assessment of water disasters, countermeasures and adaptation design, water disasters and human security
Reservoir Systems and Sustainability	2	Reservoir system and its environmental impacts, Sustainable management of reservoir system
Hydrological Frequency Analysis	3	Basic theory and application of Hydrological Frequency Analysis, which is the basis for hydrologic design.
Land Surface Processes	2	Modelling of land surface processes, Application of land surface model
Management of Large and Transboundary River Basins	2	Hydrological measurements of large river basins, Applications of hydrological modeling in of transboundary river basins
Hydro-eco Systems	2	Ecohydrological management of habitats in river ecosystems, Ecohydrological management of biodiversity in wetland ecosystems
Presentation and Discussion	2	Presentation and Discussion on related topics

**【Textbook】** Printed materials on the contents of this class are distributed in class.**【Textbook(supplemental)】** None**【Prerequisite(s)】** Elementary knowledge of hydrology and water resources engineering.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

## Case Studies Harmonizing Disaster Management and Environment

### Conservation

環境防災生存科学

【Code】 10F103 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 K. TAKARA(DPRI), H. NAKAGAWA(DPRI), E. NAKAKITA(DPRI), H. MASE(DPRI), N. MORI(DPRI), Y. YAMASHIKI(DPRI),

【Course Description】 Environmental impacts by infrastructure for disaster prevention and mitigation are discussed.

Introducing various examples of natural disasters, degradation of the environment, and harmonizing disaster management and environmental conservation in the world, this classroom carries on a dialogue about effective measures for reducing negative environmental impacts and serious disasters.

【Grading】 Considering both the number of attendances and the score of final test at the end of the semester.

【Course Goals】 Conservation of the environment and prevention/mitigation of natural disasters, which are very important for human's survivability, often conflict with each other. This course introduces various examples. Students will learn many examples harmonizing these two issues, and shall consider technical and social countermeasures fitting to the regional characteristics.

#### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
Disaster due to heavy rainfall -- utilization of weather radar and global climate change	3	Disaster due to heavy rainfall -- utilization of weather radar and global climate change
Flood disaster prevention and the environment	2	Flood disaster prevention and the environment
River environment and disaster management	2	River environment and disaster management
The environment of closed water areas / Atmosphere-ocean climate interaction	2	The environment of closed water areas / Atmosphere-ocean climate interaction
Coastal disasters due to tsunamis and storm surges	2	Coastal disasters due to tsunamis and storm surges
Projection of climate and coastal environmental change	2	Projection of climate and coastal environmental change

【Textbook】 No particular textbook for this course. Necessary documents and literature introduction are provided in the class room from time to time.

【Textbook(supplemental)】 Some literature would be introduced by professors.

【Prerequisite(s)】 No special knowledge and techniques are necessary, but requires reading, writing and discussing in English in the class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Contact Prof. Takara at <takara.kaoru.7v@kyoto-u.ac.jp> if you have any query.

# Integrated Disasters and Resources Management in Watersheds

流域管理工学

【Code】10F106 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 1st

【Location】Katsura Campus, Ujigawa Open Laboratory, Shirahama Oceanographic Observatory and Hodaka Sedimentation Observatory

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture and Exercise 【Language】English

【Instructor】Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Nozomu YONEYAMA(DPRI), Kenji KAWAIKE(DPRI), Hiroshi TAKEBAYASHI(DPRI), Daizo TSUTSUMI(DPRI), Yasuyuki BABA(DPRI),

【Course Description】Mechanism and countermeasures of sediment disasters, flood disasters, urban flood disasters and coastal disasters are explained. An integrated watershed management of these disasters and water/sediment resources is also introduced. This lecture will be open at Katsura Campus, Ujigawa Open Laboratory, Shirahama Oceanographic Observatory and Hodaka Sedimentation Observatory. Students attending this lecture must take one of the intensive experiment/field study courses offered in Ujigawa Open Laboratory and these observatories.

【Grading】Presentation, Discussion and Report

【Course Goals】Learn an integrated basin management system for natural disasters (sediment disasters, food disasters, coastal disasters, urban flood disasters) mitigation and water/sediment resources utilization considering environmental conservation.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Contents of this lecture are explained.
Urban flood disaster managemnet	2	We review urban floods from the viewpoint of river basins, flood causes, and features, together with the results of recent studies. Based on these studies, we propose comprehensive measures against urban floods, including underground inundations. In addition, we discuss on prediction methods of the tsunami disaster in urban area.
Flood disaster management	2	Prevention / mitigation measures against flood disasters and flood prediction methods are explained as well as examples of recent flood disasters in Japan.
Sediment disaster management	2	Showing the problems on sediment disasters and sediment resources, I explain an integrated sedimnet management system both for sediment disasters and sediment resources.
Coastal disaster management	2	Coastal erosion and tsunami hazard become remarkable in these days in Japanese coast. In a lecture, we discuss on characteristics of such coastal disasters.
Exercise on flood disaster at Ujigawa Open Laboratory (Selective)	6 (集中2日間)	Experiment and analysis on debris flows, riverbed variation and flooding at Ujigawa Open Laboratory, Fushimi-ku, Kyoto city.
Exercise on sediment related disaster at Hodaka Sedimentation Observatory (Selective)	6 (集中2日間)	The Hodaka Sedimentation Observatory is located at Okuhida region, Gifu Prefecture. In the field exercise, observation methods of rainfall-runoff and sediment movement processes will be explained. Field investigations into several types of erosion control facilities, sediment producing sites, debris flow sites and sediment related disaster sites will be carried out.
Exercise on coastal disaster at Shirahama Oceanographic Observatory (Selective)	6 (集中2日間)	The Shirahama Oceanographic Observatory is located in Shirahama, Wakayama Prefecture. In the lecture, the observatory, waves, currents and tide levels monitoring system is demonstrated as well as the observation tower and the observation boat.

【Textbook】None

【Textbook(supplemental)】None

【Prerequisite(s)】Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Geomechanics

地盤力学

【Code】10F025 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Fusao Oka,,Sayuri Kimoto,

【Course Description】Mechanical behavior of soils and problems of its deformation and failure, based on the multiphase mixture theory and the mechanics of granular materials, will be covered in this lecture.

【Grading】Final examination and several papers

【Course Goals】The objectives of this course are to understand the basics of geomechanics, and the advanced theories.

### 【Course Topics】

Theme	Class number of times	Description
Deformation of geomaterials	1	Mechanical property of geomaterials, Critical state soil mechanics, Failure criteria, Effective stress, Suction
	2	
elasto-plastic constitutive model	3	Constitutive model for geomaterials, Elasto-plastic model, Cam clay model
Theory of viscosity and viscoplasticity	3	Viscoelasticity, viscoplasticity, Elasto-viscoplastic mode, Adachi-Oka model, Microstructure of soils, Temperature dependent behavior, Applications of constitutive models
Consolidation analysis	3	Biot's consolidation theory and its application, Consolidation of embankment
Liquefaction of soils	2	Liquefaction of sandy soil, Damage and failure due to liquefaction, Remedial measures for liquefaction
Confirmation of achievement	1	

【Textbook】Soil mechanics, Fusao Oka, Asakura Publishing (in Japanese)

An elasto-viscoplastic constitutive model, Fusao Oka, Morikita Publishing (in Japanese)

【Textbook(supplemental)】

【Prerequisite(s)】Soil mechanics, Fundamentals of continuum mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Computational Geotechnics

計算地盤工学

【Code】 10K016 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 English

【Instructor】 ,

【Course Description】 The course provides students with the numerical modeling of soils to predict the behavior such as consolidation and chemical transport in porous media. The course will cover reviews of the constitutive models of geomaterials, and the development of fully coupled finite element formulation for solid-fluid two phase materials. Students are required to develop a finite element code for solving boundary value problems. At the end of the term, students are required to give a presentation of the results.

【Grading】 Presentation and home works

【Course Goals】 Understanding the numerical modeling of soils to predict the mechanical behavior of porous media, such as, deformation of two-phase mixture and chemical transportation.

【Course Topics】

Theme	Class number of times	Description
Guidance and Introduction	1	Fundamental concept in continuum mechanics such as deformation, stresses, and motion.
Governing equations for fluid-solid two-phase materials	2	Motion, conservation of mass, balance of linear momentum for fluid-solid two-phase materials. Constitutive models for soils, including elasticity, plasticity, and visco-plasticity.
Ground water flow and chemical transport	5	Chemical transport in porous media, advective-dispersive chemical transport.
Boundary value problem, FEM programming	5	The virtual work theorem and finite element method for two phase material are described for quasi-static and dynamic problems within the framework of infinitesimal strain theory. Programming code for consolidation analysis is presented.
Presentation	2	Students are required to give a presentation of the results.

【Textbook】 Handout will be given.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental geomechanics and numerical methods

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Geo-Risk Management**

ジオリスクマネジメント

【Code】 10F238 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Ohtsu

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with geo-risk engineering, the topics of risk analysis focusing on geotechnical structures. In detail, the contents of lectures consist of following topics: Introduction to risk analysis, Mathematical background of geo-risk evaluation, Examples of risk evaluation mainly focusing on slopes and Risk management on road slopes.

【Grading】 Attendance(10%), Report(30%), Examination(60%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance Introduction of Geo-Asset Management
Basic	4	Basics of Risk Analysis (3)
Probability theory	7	Evaluation of Slope Risk
Case Studies in Asian Countries	2	Natural Disasters in Asian Countries
Feed back	1	Feed back

【Textbook】 Hiroyasu Ohtsu, Project Management, Corona Publishing, 2010. (in Japanese)

【Textbook(supplemental)】 C. Chapman and S. Ward, Project Risk Management, John Wiley &amp; Sons, 1997.

R. Flanagan and G. Norman, Risk Management and Construction, Blackwell Science

V.M. Malhotra &amp; N.J. Carino, CRC Handbook on Nondestructive Testing of Concrete, CRC Press, 1989.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

# Fundamental Geofront Engineering

## ジオフロント工学原論

【Code】10F405 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 1st 【Location】C1 Jin-Yu Hall

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Prof. Mamoru MIMURA, Prof. Makoto KIMURA, Assoc. Prof. Yosuke HIGO

【Course Description】This course deals with near-surface quaternary soft soil deposits that are the most important in the engineering sense.

Physical properties and the mechanical characteristics of partially saturated and fully saturated soils are explained, and then various problems in terms of disaster prevention and infrastructure construction are discussed.

【Grading】Performance grading will be provided based on quality of assigned reports and presentations, etc.

【Course Goals】The aim of this course is to understand engineering problems and their mechanical background in the following points:

- Physical properties and mechanical characteristics of quaternary soft soil deposits and relevant engineering problems in terms of disaster prevention

- Fundamentals of unsaturated soil mechanics and engineering problems of earth structures in terms of disaster prevention

- Concepts of innovative underground foundations and structures and engineering problems during construction

### 【Course Topics】

Theme	Class number of times	Description
Outline of the course, introduction to quaternary deposits	1	Introduction to quaternary deposits. Types and mechanisms of geotechnical disasters relevant to quaternary deposits.
Geo-informatic database	1	Geo-informatic database and its application to modelling soft alluvial soils, liquefaction hazard map, etc.
Evaluation of subsurface structure based on GID	1	Scheme to evaluate subsurface structures using Geo-informatic database including boring logs, geophysical exploration, geological structures. Application to Kyoto basin is given.
Evaluation of liquefaction for near-surface sand deposits	1	Evaluation of liquefaction for near-surface sand deposits using Geo-informatic database is explained. Applications to the 1995 Hyogo-ken Nanbu Earthquake and the 2011 Off the Pacific Coast of Tohoku Earthquake are given, through which open questions are discussed.
Problems of soft clay deposits	1	Deformation characteristics and stability of soft clay deposits and their evaluation methods are explained, e.g., effectiveness and limitation of ground improvement, long term settlement problem, and case histories of large scale reclamation.
Concept of innovative underground structures	1	Citizen-participate-type renovation technique for unpaved roads using sandbags.
Concept of innovative underground structures	1	New construction method of embankments using consecutive precast arch culvert.
Concept of innovative underground structures	2	Technical problems of steel pipe sheet pile. Development of consecutive steel pipe sheet pile and its application.
Outline of earth structures, Unsaturated soil mechanics	2	Roles of earth structures as an infrastructure. Unsaturated soil mechanics.
Damage of earth structures caused by rainfall and earthquake	1	Case examples and their mechanisms of the damages of earth structures caused by rainfall and earthquake.
Methods to evaluate and improve stability of earth structures subjected to rainfall and earthquake	1	Design methods of earth structures and their problems are outlined.
Site visit	1	Visit construction site relevant to the issues of this course.
Evaluation and feedback	1	Evaluation of achievement by assigned reports and its feedback are given.

【Textbook】Handout will be distributed.

【Textbook(supplemental)】References are indicated in the handout.

【Prerequisite(s)】Undergraduate courses in geology, geotechnical engineering, and soil mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Public Finance**

公共財政論

【Code】 10F203 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Kobayashi, Matsushima,

【Course Description】 The concept of public finance will be taught based upon the framework of Macro economics.

【Grading】 Final Exam: 60-70%

Mid-term Exam and Attendance: 30-40%

【Course Goals】 Understand the concept of public finance

## 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Explain the outline of this course
GDP and 2. Circular flow model of macro economics	2	Explain about the circular flow model of macro economics and the definition of GDP
Input Output Table and General Equilibrium Model	2	Explain about the input-output table and its role on general equilibrium model
IS-LM Model	2	Explain about IS-LM model to analyze both goods market and money market
International Economics	2	Explain about the international account balance and IS-LM model with trade
AD-AS Model	2	Explain about AD-AS model which analyze the mid term
Economic Growth Model	2	Explain about economic growth model in which long term economic growth is analyzed
Summary	1	Summarize classes and check whether students could achieved its goal.
feedback	1	Accept feedback from students

## 【Textbook】

【Textbook(supplemental)】 Dornbusch et al., Macroeconomics 10th edition, Mcgrow-hill, 2008

【Prerequisite(s)】 Basic Microeconomics

【Independent Study Outside of Class】

【Web Sites】 will be notified in the first class.

【Additional Information】

## Urban Environmental Policy

都市社会環境論

【Code】10F207 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Dai Nakagawa and Ryoji Matsunaka,

【Course Description】 This lecture aims to learn urban environmental policy and its fundamental theory and methodology to solve social and environmental problems that occur in urban area as well as to understand the structure of these problems.

【Grading】 evaluation by commitment, tests, reports and examination

【Course Goals】 to understand the structure of social and environmental problems in urban area and urban environmental policy, its fundamental theory and methodology to solve the problems

【Course Topics】

Theme	Class number of times	Description
Outline	1	
Structure of urban problems	3	Expansion of urban areas, Increase of Environmental impact, Making compact cities
Basic theory of transportation and environment	2	Downtown activation, Road space re-allocation, Pedestrianisation
Road traffic and Public transportation	2	Characteristics of traffic modes, Light Rail Transit, Bus Rapid Transit, Mobility Management
Fundamental theory for measurements of environmental values	3	Utility, Equivalent Surplus, Compensating Surplus
Methodology to measure environmental values	3	Travel Cost Method, Hedonic Approach, Contingent Valuation Method, Conjoint Analysis
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】 basic knowledge of public economics is required

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# City Logistics

## シティロジスティクス

【Code】10F213 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】C1-172 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】English 【Instructor】Eiichi Taniguchi, Ali G. Qureshi

【Course Description】The methodologies of city logistics for establishing efficient and environmentally friendly logistics systems in urban areas will be described. Focusing on the truck traffic within road network, the process, models and the evaluation for building urban freight policy will be given. As well logistics systems using recent development of ICT, the effects of e-commerce on freight transport and supply chain management will be discussed.

【Grading】Term examination 80%, Report 10% and Quiz 10%

【Course Goals】The course goals are fully understanding the methodologies for establishing efficient, environmentally friendly and safe logistics systems in urban areas as well as obtaining the basic knowledge on modelling and evaluating city logistics initiatives.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to issues on urban freight transport is given and the importance of these issues is discussed in conjunction with urban planning.
What is city logistics?	1	City logistics are presented to totally solve problems on the efficiency of urban freight transport as well as social problems including traffic congestion, traffic environment, traffic safety and energy. The concepts of city logistics and characteristics and implementation methods are given.
Status quo and issues in freight transport--urban freight transport policy	1	The status quo and issues on freight transport is presented and urban freight transport policies are discussed for establishing efficient, environmentally friendly logistics systems in urban areas.
ITS and logistics	1	Logistics systems using ITS (Intelligent Transport Systems) are presented and how to implement city logistics initiatives using ITS is discussed.
Vehicle routing and scheduling	3	Models for optimising the visiting order and allocation of trucks in delivering goods to customers in urban areas are given and solution methodologies and practical applications are discussed. The probabilistic vehicle routing and scheduling problems with the uncertainty of travel times as well as the dynamic vehicle routing and scheduling problems with the real time travel times are also described.
Location of logistics terminals	2	The optimal location models of logistics terminals and the solution methodologies and their application to practical problems are presented. The location routing planning including vehicle routing and scheduling problems are discussed.
Cooperative freight transport systems	1	Cooperative freight transport systems which jointly operate logistics terminals, trucks and information systems are presented. The merits and demerits of cooperative freight transport systems as well as the methods for promoting them are discussed.
Application of ICT and ITS	1	It is shown that ICT (Information and Communication Technology) and ITS (Intelligent Transport Systems) allow us to collect data, transmit and analyse them relating to city logistics. The importance of ICT and ITS is emphasized.
Supply chain management, third party logistics and intermodal freight transport	1	Supply chain management, third party logistics and intermodal freight transport is presented and the innovative management systems which are used in modern logistics are discussed.
New freight transport systems	1	The categorization, characteristics and significance of new freight transport systems including underground freight transport systems are presented. The possibility of realizing new freight transport systems is discussed based on cost benefit analyses.
transport demand management and e-commerce	1	The transport demand management, which is important in city logistics is described and the difference is highlighted with the transport demand management for passenger traffic. Effects of e-commerce on urban freight transport are discussed based on recent behaviour change of consumers.
deregulation and evaluating city logistics	1	The deregulation on freight transport is described and performance indicators for evaluating city logistics initiatives are discussed.

【Textbook】1) Taniguchi, E. and T. Nemoto, City logistics--Efficient and environmentally friendly freight transport planning in urban areas, Morikita Publishing, 2001 (In Japanese).

2) Taniguchi, E., R.G. Thompson, T. Yamada and R. van Duin, City Logistics --- Network modelling and Intelligent Transport Systems. Pergamon, Oxford, 2001.

3) Taniguchi, E. and R.G. Thompson (Eds.) Innovations in freight transport, WIT Press, Southampton, 2002.

4) Taniguchi, E. (Eds.) Contemporary new city logistics, Morikita Publishing, 2005 (In Japanese).

5) Taniguchi, E., R.G. Thompson, City Logistics:Mapping the Future CRC Press, 2014.

6) Taniguchi, E., T.F. Fwa, R.G. Thompson, Urban Transportation and Logistics: Health, Safety, and Security Concerns, CRC Press, 2014.

【Textbook(supplemental)】1) Urban logistics planning, In: Urban transport II, Traffic Engineering Series, Japan Society of Traffic Engineers, 2002 (In Japanese).

2) Brewer, A. M., K.J. Button and D.A. Hensher (Eds.) Handbook of logistics and supply chain management, Pergamon, Oxford, 2001.

3) R.G. Kasilingam, Logistics and transportation, Kluwer Academic Publishers, Dordrecht, 1998.

4) OECD, Delivering the Goods---21st Century Challenges to Urban goods Transport, OECD, 2003.

5) Taniguchi, E. and R.G. Thompson (Eds.) Logistics systems for sustainable cities, Elsevier, 2004.

6) Taniguchi, E. and R.G. Thompson (Eds.) Recent advances in city logistics, Elsevier, 2006.

7) Kuse, H., K. Takada and Y. Takahashi, Logistics management in urban areas, Keiso Shobo, 2006.

8) Taniguchi, E. and R.G. Thompson (Eds.) Innovations in city logistics, Nova Science Publisher, 2008.

9) Golden, B., Raghavan, S. and Wasil, E. (Eds.) The vehicle routing problem: Latest advances and new challenges, Springer, 2008.

10) PIARC, Public sector governance on urban freight transport, 2012.

11) Tavasszy, L. and De Jong (Eds.), G. Modelling freight transport, Elsevier, 2014.

12) Ben-Akiva, M., Meersman, H. and Van de Voorde, E. Freight transport modelling, Emerald, 2014.

【Prerequisite(s)】Linear programming, optimisation, queueing theory

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Intelligent Transportation Systems

交通情報工学

【Code】10F215 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd 【Location】C1-173

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】N. Uno, T. Yamada and T. Nakamura,

【Course Description】 This class provides you with the outlines of engineering methodology with information and communication technology as its core element for improving the safety, efficiency and reliability of traffic and transportation systems and reducing the environmental burden. Concretely, we discuss the applicability of countermeasures, such as Travel Demand Management, modal-mix in transportation systems, traffic safety improvement schemes for relieving contemporary problems in traffic and transportation systems, in addition to brief introduction of innovative approaches to collect high-quality of real-time traffic data. Moreover, the methodology for policy evaluation and the related basic theory are explained.

【Grading】 Final report: 50-60%, Mid-term report: 30-40% and Attendance: 10%

【Course Goals】 Goal of this class is to cultivate basic and critical abilities of students for implementing effective traffic and transportation management using ITS (Intelligent Transportation System).

【Course Topics】

Theme	Class number of times	Description
Basics for Transportation Network Analysis	1	
Estimation of OD Traffic Volume using Observed Link Traffic Counts	1	
Analytical Approaches Based on Transportation Network Equilibrium	3	
Outlines of ITS	1	
Traffic Management for Enhancing Efficiency	2	
Innovative Approaches for Data Collection Using ICT	1	
Application of ITS for Enhancing Traffic safety	1	
Travel Demand Management and Congestion Charging	2	
Application of Traffic Simulation	2	
Examination	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantitative Methods for Behavioral Analysis**

人間行動学

【Code】10F219 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Mon 5th

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Satoshi Fujii,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	3	
	3	
	3	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Risk Management Theory**

リスクマネジメント論

【Code】 10F223 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture and exercise 【Language】 English

【Instructor】 Muneta Yokomatsu,

【Course Description】 The aim of the class is to provide the basic knowledge of risk management methods for various types of risks such as natural disaster, environment and natural resources in urban and rural areas. Students will learn the decision making principle under risks in Economics and asset pricing methods in Financial Engineering as well as have exercises of application on public project problems.

【Grading】 20% of score is valued on attendance and discussion in classes, and 80% on reports.

【Course Goals】 It is targeted to understand 1) representative concepts of risk and risk management process, 2) expected utility theory and 3) foundation of Financial Engineering, and examine 4) public project problems by applying the above knowledge.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Basic framework of risk management	2	1-1 Representative concept of risk 1-2 Risk management technologies
Decision making theory under risks	3	2-1 The Bayes' theorem 2-2 The Expected utility theory
Financial engineering	6	3-1 The Capital Asset Pricing Model 3-2 Option pricing theory 3-3 The arbitrage theorem 3-4 The Black-Scholes formula
Decision making methods for projects	3	4-1 The decision tree analysis 4-2 The real option approach
Comprehension check	1	5 Comprehension check

**【Textbook】**

【Textbook(supplemental)】 1.Ross, S.M.: An Elementary Introduction To Mathematical Finance, Cambridge University Press, 1999

2.Sullivan W.G.: Engineering Economy, Pearson, 2012

【Prerequisite(s)】 Fundamental understanding of probability

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Remote Sensing and Geographic Information Systems

## リモートセンシングと地理情報システム

【Code】10A805 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd 【Location】C1-117 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture & Exercise 【Language】Japanese 【Instructor】Masayuki Tamura, Junichi Susaki,

【Course Description】Geoinformatics is the science and technologies dealing with spatially distributed data acquired with remote sensing, digital photogrammetry, global positioning system, etc, to address the problems in natural phenomena or human activities. This lecture particularly focuses on satellite remote sensing and explains the theory and the technologies for analyzing environmental changes or disaster effects. A free software "MultiSpec" is used in exercises to learn the basic techniques of image processing.

【Grading】Grading is based on the achievements in home works given in every lesson.

【Course Goals】To understand the basic theory and to acquire the basic techniques of satellite remote sensing for observation and analysis of environmental changes and disaster effects.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	1. Introduction to remote sensing 2. Applications in environmental and disaster prevention fields
Radiation and reflection of electromagnetic waves	1	1. Classification of electromagnetic waves 2. Basic terms on electromagnetic radiation 3. Theory of electromagnetic radiation from objects 4. Classification of satellite sensors by observation wavelengths
Atmospheric effects on satellite observations	1	1. Absorption and scattering of electromagnetic waves by atmospheric particles 2. Atmospheric radiative transfer of electromagnetic waves 3. Atmospheric effects on satellite observations 4. Correction of atmospheric effects
Satellite sensors	1	1. Principles of visible and infrared sensors 2. Examples of visible and infrared sensors 3. Applications of infrared sensors
Image correction	1	1. Image processing procedure 2. Image enhancement 3. Image correction 4. Correction of geometrical distortion
Image classification	1	1. What is image classification? 2. Theory of image classification 3. Classification rules 4. Image classification procedure
SAR imaging I	1	1. Microwave radiation 2. Scattering of microwave 3. Real aperture radar
SAR imaging II	1	1. Synthetic aperture radar 2. Geometrical distortion of radar images
Property of SAR data	1	1. Statistical property of SAR data 2. Speckle filter 3. Expression of polarimetric characteristics
Measurement of topography using SAR data	1	1. SAR stereoscopy 2. SAR interferometry 3. Differential SAR interferometry
Monitoring land deformation using multiple SAR data	1	1. Stacking SAR data 2. PSInSAR 3. SBAS
Analysis of digital elevation data	1	1. Spatial filtering 2. Generation of shaded relief
Raster and vector maps	1	1. Raster maps 2. Vector maps 3. Handling of vector maps
Generation of DEM from airborne LIDAR data	1	1. Airborne LIDAR 2. Processing LIDAR data 3. Interpolation of spatial point data
Assessment of understanding	1	Assess students' understanding levels

【Textbook】

【Textbook(supplemental)】• W. G. Rees , Physical Principles of Remote Sensing 3rd ed., Cambridge University Press, 2013.

• J. A. Richards and X. Jia , Remote Sensing Digital Image Analysis: An Introduction, 5th ed., Springer-Verlag, 2013.

• M. Netler and H. Mitasova, Open Source GIS: A GRASS GIS Approach 3rd ed., The International Series in Engineering and Computer Science, 2008.

【Prerequisite(s)】Basic knowledge in computer information processing

【Independent Study Outside of Class】

【Web Sites】<http://www.envinfo.uee.kyoto-u.ac.jp/user/tamura/rsgis.html>

【Additional Information】

**Civic and Landscape Design**

景観デザイン論

【Code】 10A808 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and practice

【Language】 Japanese 【Instructor】 Masashi Kawasaki, Yoshiaki Kubota, Keita Yamaguchi, Keiichiro Okabe,

【Course Description】

【Grading】 Reports (Kawasaki: 50%) and design practice (Okabe: 50%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance. Landscape and image	1	
Architectural Design of city and urban facilities	2	
Atmosphere and color of Japan	1	
Design of waterfronts	1	
Design of bridges	1	
Design of Urban landscape	2	
Landscape policy and design management	1	
Design practice	5	
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Computational Mechanics and Simulation

計算力学及びシミュレーション

【Code】10K008 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Exercises 【Language】English

【Instructor】Ishida, Lin, Furukawa, Flores,

【Course Description】The process to obtain numerical solutions for various problems in computational mechanics.

Discretization and some solving technique for initial/boundary value problems is to be introduced by the FEM. Fundamental concept of boundary element method (BEM) and its applications in the engineering field will be introduced. Statistical mechanics, molecular dynamics, Monte Carlo method and Multiple scale model will be shortly introduced in order to understand the basic theory of molecular dynamics simulation. Their applications to engineering problems are to be also given by showing some up-to-date examples. Theory of the distinct element method (DEM) will be lectured, and its application in the engineering field will also be explained. Study of contaminant migration in subsurface via groundwater flow modelling coupled with advective-dispersive solute transport. The general groundwater flow and chemical transport in porous media are introduced, then the governing equations for advective-dispersive chemical transport, and the analytical solution of the governing equations are explained. This course will be given in English.

【Grading】Achievement is evaluated by submitted reports to each topic.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Finite difference method	3	Explicit-FDM is explained using an example of unsteady motion of a mass point based on Voigt model. In addition, the numerical simulation results are compared to their theoretical solutions and discussed.
Boundary element method and Molecular dynamics simulation	4	Fundamental concept of boundary element method (BEM) and its applications in the engineering field will be introduced. Monte Carlo method and Multiple scale model will be shortly introduced in order to understand the basic theory of molecular dynamics simulation. Their application to engineering problems are to be also given by showing some up-to-date examples.
Distinct element method and its application	4	Theory of the distinct element method (DEM) will be lectured in this item. The DEM is the numerical analysis method for discontinuum. The application of the DEM in the engineering field will also be explained.
Migration of Contaminants in Subsurface	3	Study of contaminant migration in subsurface via groundwater flow modelling coupled with advective-dispersive solute transport. In this section, we will first introduce the general groundwater flow and chemical transport in porous media, then we will learn about the governing equations for advective-dispersive chemical transport, and finally we will define the parameters and find the analytical solution of the governing equations. Some numerical results will be used as examples to understand the process.
Confirmation of the learning achievement degree	1	Confirmation of the learning achievement degree

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Applied Elasticity for Rock Mechanics

応用弾性学

【Code】10F071 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 3rd  
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】S. Murata

【Course Description】Theory of elasticity relating to the deformation and failure of rock and rock mass and design of rock structures is explained. Specifically, two-dimensional and three-dimensional analysis of elasticity using the basic equations, constitutive equations, and the complex stress function are explained. Several applications of this analysis to rock mechanics, rock engineering, and fracture mechanics are also explained.

【Grading】Evaluation is made by the score of two report problems or homework and semester final exam.

【Course Goals】The goal of this class is to master the theory of elasticity so as to solve the elastic problem in rock mechanics, rock engineering, and fracture mechanics.

### 【Course Topics】

Theme	Class number of times	Description
Airy ' s stress function and complex stress function	2	Airy ' s stress function used to solve a two-dimensional elastic problem is first explained, and then the complex stress functions that are the representation of Airy ' s stress function by the complex variables are explained.
Two-dimensional elastic analysis using the complex stress function	8	Analytical solutions of two-dimensional elastic problems in fracture mechanics and rock engineering are derived by using the complex stress functions. The mechanical behavior of rock material is also explained based on the derived solutions.
Application of two-dimensional elastic analysis	2	The theory of rock support, ground characteristic curve, theoretical equations used for the evaluation of rock stress, which are derived from the solution of two-dimensional elastic problem, are explained.
Three-dimensional theory of elasticity	2	Stress functions to solve the three-dimensional elastic problem are explained, and some examples of the three-dimensional elasticity solution are explained.
Summary and Achievement check	1	The contents of this class are summarized. In addition, the achievement of course goals is checked.

【Textbook】Handouts are delivered.

【Textbook(supplemental)】J.C. Jaeger, N.G.W. Cook, and R.W. Zimmerman: Fundamentals of Rock Mechanics -4th ed., Blackwell Publishing, 2007, ISBN-13: 978-0-632-05759-7

【Prerequisite(s)】The knowledge and calculation skill of calculus, vector analysis and complex analysis are required.

【Independent Study Outside of Class】

【Web Sites】Web page of this lecture is not specifically provided. When preparing it by need, the information is shown in the class.

【Additional Information】Not specified

## Fundamental Theories in Geophysical Exploration

物理探査の基礎数理

【Code】10F073 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 5th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hitosih Mikada, Tada-nori Goto,

【Course Description】We are outlining various basic mathematical principles used for the analysis of the dynamic and kinematic earth-scientific problems in conjunction with wave propagation, mass transfer, etc. in the crust, and presenting examples of such analysis techniques in the area of earth sciences and earth resources engineering.

【Grading】Rating is performed by the combination of exams (40%) and the attendance to the class (60%).

【Course Goals】The aims of the class is to understand various signal-processing theories, the applied seismology, and the applied geo-electromagnetics with respect to exploration geophysics as application tools in seismology and in geo-electromagnetics.

### 【Course Topics】

Theme	Class number of times	Description
Introduction to exploration geophysics	1	General introduction to the lecture.
Seismic wave propagation and signal processing	8	Acquire knowledge on the propagation phenomena of elastic waves to learn the equivalency of 1D propagation with the theory of system function. The topics included would be, z-transform, Levinson recursion, Hilbert transform, etc.
Fundamentals of geo-electromagnetics and their application to exploration geophysics	5	Learn fundamental theories of magnetotellurics, instantaneous potential, spontaneous potential, and apparent resistivity methods, etc. that deal with geo-electromagnetic phenomena. Case studies are introduced to understand the advantages of geo-electromagnetic exploration schemes.
Wave propagation problem in seismic exploration	1	Discussing fundamental theories of elastic wave propagation, used in subsurface structural surveys, in terms of the actual utilization and the theories of wave phenomena.

### 【Textbook】

【Textbook(supplemental)】Claerbout, J.F. (1976): Fundamentals of Geophysical Data Processing (Available online URL: <http://sep.stanford.edu/oldreports/fgdp2/>)

【Prerequisite(s)】Students should understand exploration geophysics of undergraduate level.

### 【Independent Study Outside of Class】

【Web Sites】Could be specified by the lecturers if any.

### 【Additional Information】

**Environmental Geosphere Engineering**

地殻環境工学

【Code】10A405 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Katsuaki KOIKE,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction of structure and content of this course	1	
Physics of Earth system	2	
Chemistry of Earth system	1.5	
Fundamentals of Geoinformatics (1): Spatical modeling techniques	2.5	
Fundamentals of Geoinformatics (2): Scaling of geological structure	1	
Fundamentals of Geoinformatics (3): Remote sensing	3	
Fundamentals of Geoinformatics (4): Earth survey and geochemical exploration	1	
Geosphere environments (1): Weathering process and geohazards	1	
Geosphere environments (2): CCS and HLW	1	
Mineral and energy resources	1	

【Textbook】Handouts will be distributed at each class.

【Textbook(supplemental)】References will be introduced in the handouts.

【Prerequisite(s)】Fundamental knowledges on geology, physics, and chemistry are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Energy System Management

エネルギー基盤マネジメント工学

【Code】10F086 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English 【Instructor】Katsuaki Koike,  
【Course Description】Securance and development harmonious with natural environments of the mineral and fossil energy resources, and utilization of storage function of geologic strata have become important issues for constructing sustainable society. This subject introduces comprehensively the present situation of uses of mineral and energy resources, crust structure and dynamics, economic geology for the genesis and geologic environments of deposits, physical and chemical exploration methods of marine deposits, mathematical geology for reserve assessment, engineering geology for resource development and geological repository, and problems and promisingness of natural energy such as geothermal, solar, wind, and tide.

【Grading】Integrated evaluation by attendance to the classes and report grades

【Course Goals】To find out directionality about the technologies required for constructing sustainable society by yourself with full understandings of genetic mechanism, biased distribution, and the present situation of demand and supply of the mineral and energy resources.

### 【Course Topics】

Theme	Class number of times	Description
Introduction of this course and resources	1	Definition of renewable and non-renewable resources. Interaction among Earth environment, human society, and natural resources. Existence pattern of natural resources in the crust.
1. Internal structure of Earth and geodynamics	1	Inner structure of the Earth, geodynamics, geologic composition, temperature structure, rock physics, and chemical composition of crust.
2. Present and future of energy resources	1.5	Classification of energy sources, recent trend on social demand of energy, physical characteristics of each energy resources, and sustainability.
3. Present and future of mineral resources	1.5	Classification of minerals used for resources, recent trend on social demand of mineral resources, industrial uses of each mineral, and sustainability.
4. Economic geology (1)	1	Classification of ore deposits, distribution of each type of ore deposit, generation mechanism of deposit.
4. Economic geology (2)	1	General structure and distribution of fuel deposits (coal, petroleum, and natural gas), generation mechanism of deposits, and geological process of formation.
5. Resource exploration (1): Terrestrial area	1	Physical and chemical exploration technologies for natural resources in terrestrial area. Representative methods are remote sensing, electric sounding, electromagnetic survey, and seismic prospecting.
6. Resource exploration (2): Sea area	1	Introduction of marine natural resources such as methane hydrate, cobalt-rich crust, and manganese nodule, and exploration technologies for the deposits in sea area.
7. Assessment of ore reserves and deposit characterization	1	Fundamentals of geostatistics, variography for spatial correlation structure, spatial modeling by kriging, geostatistical simulation, integration of hard and soft data, and feasibility study.
8. Resource development	1	Development and management technologies of energy resources related to coal, petroleum, and natural gas.
9. Engineering geology	2	Fundamentals of deep geological repository for high-level nuclear waste, CCS (carbon dioxide capture and storage), and underground storage of petroleum and gas.
10. Sustainability	2	Characteristics of natural energy related to geothermal, solar, wind, and tide, and assessment of natural energy resources. Co-existence of natural resource development with environment, low-carbon society, and problems for human sustainability.

【Textbook】Printed materials on the class contents are distributed before each class.

【Textbook(supplemental)】References on each topic will be instructed in classes.

【Prerequisite(s)】Elementary knowledge of engineering, mathematics, physics, and geology.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This course is opened every two years, and opened in 2013.

**Water Sanitary Engineering**

水質衛生工学

【Code】 10F234 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English/Japanese 【Instructor】 Sadahiko Itoh, Shinya Echigo,

【Course Description】 The ultimate goal of this course is to understand "Sanitary Engineering" quantitatively. Students will learn methods to quantify chemical and microbial risk in drinking water and realize concept and methods of risk management and control.

【Grading】 Evaluated by assignments.

【Course Goals】 To quantify chemical and microbial risk in drinking water and to realize methodologies of risk management and control.

## 【Course Topics】

Theme	Class number of times	Description
Environmental risk and quantification	1	Introduction and goal of the class. Concept of "Sanitation". Environmental risk and quantification. Safety of drinking water and acceptable risk level.
Risk assessment and control of hazardous chemicals	3	Risk assessment of hazardous chemicals. Drinking water quality standards. Derivation of drinking water quality standards. The benchmark dose method.
Quantitative microbial risk assessment and management	5	Coexistence and competition between human and microbes. Quantitative microbial risk assessment (QMRA). Comparison of the risk assessment and management methods between chemicals and microbes. Disability adjusted life years (DALYs).
Perspectives of water treatment technology	5	Development of advanced water treatment processes. Water supply technology and its prospects. Water reuse and health risk. Access to safe drinking water in developing countries and global burden of disease.
Feedback and summary	1	Feedback of assignments and summary.

【Textbook】 Class handouts

【Textbook(supplemental)】 Itoh, S., Echigo, S.: Disinfection By-products in Water, GIHOUDOU SHUPPAN Co., Ltd., 2008 (in Japanese).

【Prerequisite(s)】 General understanding of water quality and water treatment process

【Independent Study Outside of Class】

【Web Sites】 Data for assignments will be at <http://www.urban.env.kyoto-u.ac.jp>

【Additional Information】

**Ecomaterial and Environment-friendly Structures**

環境材料設計学

【Code】10F415 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 1st

【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirotaka KAWANO,Atsushi HATTORI,Toshiyuki ISHIKAWA,

【Course Description】Lecture on outline of impact of construction materials to environment and influence on materials and structures from environment. Discuss how to use materials sustainably. Keywords are concrete, steel, composite materials, CO<sub>2</sub>, durability, recycle and reuse, life-cycle assessment.

【Grading】Attendance( %), Report( %),Presentation( %)

【Course Goals】To understand the limit of resources and effect of material use to environment. and to understand the basic theory to make environmental-friendly infrastructures from the view point of materials use.

## 【Course Topics】

Theme	Class number of times	Description
Guidance	1	Object of the Course, Grading and Goals
product of materials and impact to environment	1	Product of cement, steel, concrete CO <sub>2</sub> product and its influence
recycle and reuse of materials	3	Recycle and reuse of steel, metals, concrete, asphalt, plastics Technology development of construction materials
deterioration of concrete structures	1	Mechanism of deterioration of concrete structures: carbonation, salt attack, alkali-aggregate reaction Maintenance and retrofit methods
deterioration of steel structures	1	Mechanism of deterioration of steel structures: corrosion, fatigue Maintenance and retrofit methods
deterioration of composite structures	1	Mechanism of deterioration of composite structures: Maintenance and retrofit methods
life-cycle assessment of structures	1	Life-cycle assessment of structures considering initial cost as well as maintenance cost
topics and discussion	2	Recent topics on construction materials and discussion
presentation by students and discussion / feedback	4	Presentation by students on the individual topics Discussion on the topics. "Feedback" at the last class

【Textbook】No set text

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Basic knowledge of construction materials, concrete engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Questions and discussions are welcome

## Systems Approach on Sound Material Cycles Society

### 循環型社会システム論

【Code】10F454 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd 【Location】C1-192

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Shinichi Sakai, Yasuhiro Hirai,

【Course Description】It has become a major political/ social issue to establish a Sound Material-Cycle Society in order to save the earth resources and energy and to preserve environmental conservation. This course mainly covers the following topics: 1) History, current status, and future prospect of waste issues and establishment of a sound material-cycles society. 2) Basic concepts and current conditions/ challenges of the following items: The Basic Law for Establishing the Material Cycles Society and the Basic Plan for accomplishing it; Containers and Packaging Recycling Law; Home Appliance Recycling Law; End-of-Life Vehicle Recycling Law and others. 3) Basic concept and application of material flow analysis and life cycle assessment; these tools are important to grasp the whole flow of each recycling, resource use, product consumption, recycle and disposal of waste electrical and electronic equipment, for which it is required to take Clean Cycle & Control concepts in relation to chemical substances. Along with above topics, source origin, behavior, and decomposition of persistent organic pollutants, which should be inevitably linked to the realization of a Sound Material-Cycle Society, will also be discussed in the class.

【Grading】Evaluation will be done based on the test scores and learning attitude in class.

【Course Goals】The goal of this class is to help students understand the systems and technologies for establishing a Sound Material Cycles Society; students learn how to think about material flow analysis and life cycle assessment in order to develop deep understanding of the whole system of material flow (i.e., resource use, product consumption, cycles and disposal of waste).

#### 【Course Topics】

Theme	Class number of times	Description
The Basic Law for Establishing the Material Cycles Society and the Basic Plan for Material Cycles	1	Learn the frame work and three indices of this basic plan in detail, and examine recent globally developed “ 3R Initiative ” activities and status of material cycles in Asian countries.
Development of Each Recycling System	3	Learn the following items separately designated as effective measures under The Basic Law for Establishing the Material Cycles Society: 1) Containers and packaging 2) Home Appliance 3) End-of-Life Vehicle 4) Construction Material 5) Food Material
Each Recycling System and Clean, Cycles & Control Concepts	3	Examine application of the following strategic concepts for waste electrical and electronic equipment, end-of-life vehicles, and battery waste. 1) Clean: Avoid the use of hazardous waste and chemical substances. 2) Cycle: Apply cycle concept when use effects are expected but no alternatives are available.
Basic concept and application of material flow and life cycle analyses	5	Learn about basic concept of Material Flow Analysis (MFA) and Life Cycle Assessment (LCA). Examine food waste recycling using these analyses as a case study.
Environmental Transport Model and Behavior of Persistent Organic Pollutants (POPs)	2	Learn basic concept and application of the model. Examine case studies of global mobility of POPs and behavior of PCB on regional and global scales.
Confirmation of Attainment	1	Confirm students ’ levels of understanding on the course topics, and make sure of the points of MFA, LCA, and systems and techniques for establishing a sound material-cycle society.

【Textbook】Not specified. Materials and references will be distributed when needed.

【Textbook(supplemental)】Introduced in class when necessary.

【Prerequisite(s)】Solid Waste Management

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Atmospheric and Global Environmental Engineering, Adv.**

大気・地球環境工学特論

【Code】 10F446 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese/English

【Instructor】 Yuzuru MATSUOKA, Gakuji KURATA,

【Course Description】 The contents of the lecture are as follows. (1) History of Global Warming problem, Radiative forcing, Green house gas emission, Carbon cycle, Mechanism of Climate Change, Mitigation measures, Social and Natural impact of Climate change (2) Mechanism of formation of Photochemical oxidant and Acid rain, Global scale transportation of atmospheric pollutants, Deposition and its impact of air pollutants, control measure of air pollution.

【Grading】 A quiz is carried out at the beginning of every lectures.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance, IPCC, Observation of a climate change	1 (Matsuoka)	
Radiative forcing	1 (Matsuoka)	
Greenhouse gas	1 (Matsuoka)	
Carbon cycle and response of climate	1 (Matsuoka)	
Impact of Climate Change	1 (Matsuoka)	
Energy system and mitigation of climate change	1 (Matsuoka)	
Cross-border transportation and the international measure against air pollution	1 (Kurata)	
Urban Air pollution	1 (Kurata)	
Acid Deposition and its impact	1 (Kurata)	
Simulation of advection and diffusion	1 (Kurata)	
Simulation of Atmospheric Chemistry	1 (Kurata)	
Indoor air pollution and health impact	1 (Kurata)	
Practice	2 (Kurata and Matsuoka)	
Achievement test	1	

【Textbook】 Handout

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Environmental Health**

環境衛生学特論

【Code】10A626 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 3rd  
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese  
 【Instructor】Hirohisa Takano,Kayo Ueda,

【Course Description】Environmental factors and genetic factors are responsible for our health and diseases. This seminar has the lecture on the relationships between environmental factors and our health. Also, Students make presentation and discussion on the previous and recent environmental problems, with special emphasis on their relation with health concerns.

【Grading】Points are allocated for the activities on the presentation and discussion.

【Course Goals】Students learn about the fundamentals of environmental health and make use of the knowledge for the development of related areas.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Environment and health	1	Lecture on the relationships between environmental factors and our health
Seminar on the previous and recent environmental problems	14	Presentation and discussion on the previous and recent environmental problems, with special emphasis on their relation with health concerns

【Textbook】on demand

【Textbook(supplemental)】on demand

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Urban Metabolism Engineering

都市代謝工学

【Code】 10A632 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English / Japanese 【Instructor】 Masaki Takaoka, Gakuji Kurata, Kazuyuki Oshita,

【Course Description】 Much energy and resources are consumed to maintain various activities in urban city. As the result, various environmental loads such as exhaust gas, wastewater and waste generate and should be reduced to levels natural environment can accept. To establish sustainable urban metabolism, concept, elements, control, optimization and management of urban metabolism are explained.

【Grading】 Small tests and reports are evaluated.

【Course Goals】 To understand technological measures by learning about current trend and issue of urban metabolism and related engineering principles.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Concept of urban metabolism and its system are explained
Elements of urban metabolic system	7	Planning and selection of urban metabolic system, Transportation & collection, Engineering principles on Recycling, Thermal recovery, Engineering principles on flue gas treatment and Landfill management are explained.
Control, optimization and management of urban metabolic system and environmental equipment	4	Fundamentals of control theory, optimization, system identification and simulation of urban metabolic system and environmental equipment
Design of sewage treatment system in urban area	2	Properties and chemical compositions of sewage and sludge. Introduction and developing trend of sewage treatment system. Elemental and heat balance analysis of sedimentation, aeration tank, anaerobic fermentation and incineration.
Feedback and summary	1	Feedback of small tests and summary

【Textbook】 Recent paper and/or books will be used.

【Textbook(supplemental)】

【Prerequisite(s)】 Environmental plant engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Environmental Microbiology, Adv.**

環境微生物学特論

【Code】10A643 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Mon 1st

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroshi TSUNO, Hiroaki TANAKA, Fumitake NISHIMURA, Naoyuki YAMASHITA,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	1	
	1	
	1	
	1	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## New Environmental Engineering I, Advanced

### 新環境工学特論 I

【Code】 10F456 【Course Year】 2013 【Term】 1st term 【Class day & Period】 Mon 5th

【Location】 Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 Y. Shimizu (Prof), H. Tanaka (Prof), and S. Fujii (Prof),

【Course Description】 This course provides various kinds of engineering issues related to the water environment in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students.

The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University of China. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system).

【Grading】 Evaluated by class attendance, Q&A and presentation.

【Course Goals】 Each student is requested to give a short presentation in English in the end of the course. The students will understand the present circumstance of environments in the world, and the students may improve their English skill and international senses through these lectures, presentations, and discussions.

#### 【Course Topics】

Theme	Class number of times	Description
Wastewater Treatment in Japan	1.4	Guidance & self introduction of students & lecturer on “ Wastewater Treatment Plants Case Study in Japan (Fujii)
Ecological Sanitation	1.4	From Ecotoilets to Ecotowns ( Shimizu)
Wastewater Reuse	1.4	Wastewater Reuse & Disinfection (Tanaka)
Membrane Treatment	1.3	Treatment Technologies (Practical & Advanced Technology I): Membrane Technology (MT) (Prof. Huang, Tsinghua University)
POPs	1.4	Global POPs (Persistent Organic Pollutants) Pollution, and Countermeasures (Fujii)
Wastewater Treatment in Malaysia	1.3	Wastewater Treatment Plants Case Study in Malaysia - Design Consideration - (Prof. Ghazaly, University of Malaya)
Anaerobic Treatment	1.3	Anaerobic Biological Treatment Technologies (Prof. Shaliza, University of Malaya)
Wastewater Treatment in China	1.3	Wastewater Treatment Plant: Case Study in China, Biological Nutrient Removal (Prof. Wen, Tsinghua University)
Water Pollution in Malaysia	1.4	History of Water Pollution in Malaysia (Prof. Ghufuran, University of Malaya)
Student Presentation	1.4	Student Presentations /Discussions I (all)
Student Presentation	1.4	Student Presentations /Discussions II (all)

【Textbook】 Class handouts

【Textbook(supplemental)】 Introduced in the classes

【Prerequisite(s)】 General understanding of water environmental issues

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Either of this course or “ New Environmental Engineering II, advanced ” can be dealt as “ Asian Environmental Engineering ” . PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

## New Environmental Engineering II, Advanced

### 新環境工学特論 II

【Code】 10F458 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 5th

【Location】 Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 Prof. Matsuoka, Prof. Shimidzu, Prof. Takaoka, Associate Prof. Kurata, Prof. Fujii,

【Course Description】 This course provides various kinds of engineering issues related to atmospheric environment and solid wastes management in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students. The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system). The students are requested to give a short presentation in English in the end of the lecture course. This course may improve students' English skill and international senses through these lectures, presentations, and discussions.

【Grading】 Evaluate by class attendance, Q&A and presentation.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Global warming and Low carbon society	1.4	Global warming and Low carbon society (Matsuoka)
Atmospheric diffusion and modeling	1.4	Atmospheric diffusion and modeling (Prof. S Wang, Tsinghua University)
Air Pollution, Its Historical Perspective from Asian Countries (I),China	1.4	Air Pollution, Its Historical Perspective from Asian Countries (I),China (Prof. Hao, Tsinghua University)
Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia	1.4	Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia (Prof. Nik, University of Malaya)
Air Pollution, Its Historical Perspective from Asian Countries (III), Japan	1.4	Air Pollution, Its Historical Perspective from Asian Countries (III), Japan (Kurata)
Student Presentations /Discussions I	1.4	Student Presentations /Discussions I (all)
Introduction to Municipal Solid Waste (MSW) Management in Malaysia	1.4	Introduction to Municipal Solid Waste (MSW) Management in Malaysia (Prof. Agamuthu, University of Malaya)
Solid Waste Management, Case Study in China	1.4	Solid Waste Management, Case Study in China (Prof. Wang, Tsinghua University)
Solid Waste Management, Case Study in Japan	1.4	Solid Waste Management, Case Study in Japan (Takaoka )
Solid Waste Management, Case Study in Malaysia	1.4	Solid Waste Management, Case Study in Malaysia (Prof. Agamuthu, University of Malaya)
Student Presentations /Discussions II	1	Student Presentations /Discussions II (all)

【Textbook】 Class handouts

【Textbook(supplemental)】 Introduce in the lecture classes

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Either of this course or “ New Environmental Engineering I, advanced ” can be dealt as “ Asian Environmental Enigneering ”. PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

**Nuclear Environmental Engineering, Adv.**

## 原子力環境工学

【Code】10F461 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 2nd 【Location】C1-192 【Credits】2  
 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】Japanese 【Instructor】Yoko Fujikawa,Satoshi Fukutani, Maiko Ikegami  
 【Course Description】Various wastes are generated from the use of nuclear energy, one of the key technologies to overcome the global warming, and the associated industrial activity. This course is intended to understand the type and origin of radioactive wastes, as well as the management, treatment, and final disposal of these wastes, from the viewpoint of environmental engineering.

【Grading】Attendance to the lecture plus report

【Course Goals】By providing the students with the knowledge on various radioactive wastes generated by the use on nuclear energy as well as the radiological risk of such wastes, the course will enable the students to consider the future of nuclear industries based on their own judgement.

## 【Course Topics】

Theme	Class number of times	Description
Course Introduction	1	Course Introduction
Nuclear disaster action program	1	uclear disaster action program
Nuclear reactors	1	Nuclear reactors
Treatment of liquid radioactive waste	1	Treatment of liquid radioactive waste
Treatment of gaseous and solid radioactive waste	1	Treatment of gaseous and solid radioactive waste
Legislation of radioactive wastes	1	Legislation of radioactive wastes
Decommissioning and clearance	1	ecommissioning and clearance
Radiological risk	1	The risk of radiation exposure, history of radiation dose limit set by international organizations, and dose limit under different situations are discussed
Fukushima Daiichi Nuclear Power Plant (F1) accident and nuclear disaster prevention	1	Discuss the relation between the events in F1 and the radiation dose in the environment as well as pollution of environment. The evacuation activity conducted in Fukushima and the related lessons are summarized.
Problems of designated waste	1	In the aftermath of the F1 accident, municipal solid waste contaminated with radioactive cesium has been produced in 12 Prefectures, some of these wastes were classified as designated wastes (DSW). The concept of DSW is compared with that of conventional radioactive wastes.
Geological disposal of high level radioactive wastes (HLW) and the safety assessment	1	Inventory, the method of disposal (critical path and nuclides), philosophy of radiological protection, etc. are discussed.
Behavior of radionuclides in the environment and mathematical modeling of nuclide migration	1	Behavior of radionuclides in the geosphere has governing effect on the safety of geological disposal of HLW. The behavior based on the chemical characteristics of each nuclides and mathematical modeling of their behavior are discussed.
Behavior and qualitative/quantitative analysis of radionuclides in the environment	1	Behavior and qualitative/ quantitative analysis of radioactive Cs, Co, Sr, I, Se, U, Pu and Ra in the environment, and events of radioactive pollution of the environment in the past, are introduced.
The risk of radiation and the society	1	After the F1 accident, the risk of radiation has drawn intense attention from citizens. The risk communication methodology to facilitate the understanding of radiation is discussed.
Discussion with /between students	1	Discussion on issues such as lifestyle in the contaminated environment (under existing exposure situation), whether residents should return to the contaminated areas, and how to deal with siting problems of final disposal of HLW, etc..

【Textbook】Related papers etc. will be distributed in each lecture.

【Textbook(supplemental)】Related literature will be notified in each lecture.

【Prerequisite(s)】Basic knowledge on health physics, chemistry and earth science.

【Independent Study Outside of Class】NOT specified.

【Web Sites】None

【Additional Information】None

**Environmental-friendly Technology for Sound Material Cycle**

環境資源循環技術

【Code】10H424 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 3rd

【Location】C1-192 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,,,,

【Course Description】 Global warming, ecosystem crisis, and depletion of natural resources are of great concern today. To solve these problems, we have to build the sustainable society where low carbon dioxide emission, low environmental burdens, and the reduction of wastes by recycling are realized. It is possible to utilize municipal wastes, wastewaters, and unused biomass as resources instead of the natural resources used at present. Recycling-oriented technologies that enable sustainable utilization of those wastes and the concept to develop those technologies are introduced.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Environmental Organic Micropollutants Analysis Lab.**

環境微量分析演習

【Code】 10F468 【Course Year】 Master and Doctor Course 【Term】 Intensive course (25th, 28-29th Sep.)

【Class day &amp; Period】 9:00 am- 6:00 pm

【Location】 Seminar Room, Research Center for Environmental Quality Management 【Credits】 2

【Restriction】 around 10 students 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 Shimizu, Yoshihisa, Matsuda, Tomonari,

【Course Description】 There is increasing concern about proper risk evaluation and management of hazardous chemicals such as dioxins and endocrine disruptors. To manage this problem, it is necessary to understand analytical methods and toxicity of those hazardous chemicals. In this class, lectures and experiments will be carried out about chromatography, bioassays and mass spectrometry.

【Grading】 It is required to attend all 3 days for lectures and experiments. Attendance and reports are considered for grading.

【Course Goals】 Understand about principle and practical techniques of chromatography. Understand about principle of several bioassays.

## 【Course Topics】

Theme	Class number of times	Description
HPLC -How to separate it-	3	Learn about principle and practice of HPLC separation. How do you choose columns, solvents and detectors? How to improve peak separation?
Fractionation and Purification by using HPLC	3	Learn about practical techniques of fractionation and purification using HPLC.
LC/MS/MS	5	Learn about principle and practice of LC/MS/MS analysis. Understand about 3 different scan modes, full scan, daughter scan and MRM. How to make an analytical method in a refined way for substances of your interest.
Bioassays	4	Lecture about several bioassays which are used for evaluation of environmental toxicity, and discuss about how to identify toxic compounds in environment by using HPLC in combination with bioassays.

【Textbook】 Handouts are distributed.

【Textbook(supplemental)】 Daniel C. Harris: "Quantitative Chemical Analysis" ISBN-13: 978-1-4292-3989-9

【Prerequisite(s)】

【Independent Study Outside of Class】 We hope active participation of students. It is welcome that participants additionally try to analyze the sample their own interest.

【Web Sites】

【Additional Information】 This intensive course is useful especially for students who usually use or intend to use HPLC and LC/MS/MS for their research.

**Advanced Environmental Engineering Lab.**

環境工学先端実験演習

【Code】 10F470 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day &amp; Period】 Monday 3,4 【Location】 C1-173 【Credits】 2 【Restriction】 less than 10 students

【Lecture Form(s)】 Seminar and Exercise 【Language】 English / Japanese

【Instructor】 Sadahiko Itoh, Minoru Yoneda, Masaki Takaoka, Shinya Echigo, Gakuji Kurata, Makoto Yasojima,

【Course Description】 Analytical methods to characterize environmental samples are learnt through practical training including site visit to other research institute or analytical company. Also, integration of environmental information using GIS is also mastered.

【Grading】 Attendance at the class and report subjects are evaluated.

【Course Goals】 To promote your own research by learning each research method with wide vision

## 【Course Topics】

Theme	Class number of times	Description
Guidance and Safety Education	1	The content of subject and safety education for the following experiment are explained.
Quantitative analysis of elements	3	The principle of multielement analysis is explained and practical training of ICP-AES or ICP-MS machine is conducted.
Qualitative analysis of elements	2	The principle of X-ray based methods is explained and practical training of one or two X-ray based machine is conducted.
Qualitative analysis of organic compounds and bioassay	5	Qualitative analysis of organic compounds such as mass spectrometry, NMR, ESR and IR and bioassay are explained and practical training of GC-MS etc. is conducted.
GIS	3	The way to use GIS is learnt.
Site visit	1	Site visit to research institute or analytical company

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminer on Practical Issues in Urban and Environmental Engineering**

環境工学実践セミナー

【Code】10F472 【Course Year】Master Course 【Term】1st+2nd term 【Class day &amp; Period】Fri 4th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Transport Phenomena**

熱物質移動論

【Code】 10G039 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd  
 【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese  
 【Instructor】 Nakabe, Kazuyoshi, Tatsumi, Kazuya,

【Course Description】 The important learning objective of this class is to understand the fundamental mechanisms of momentum, heat, and mass transfer phenomena, the knowledge of which will be markedly required for the thermal energy control technologies to further practice conservations of natural resources and energies for sustainable development. Heat and mass transfer processes consisting of conduction and forced/natural convection will be highlighted in detail, referring to the similarity characteristics of flow velocity, fluid temperature, and species concentration. Some topics on Reynolds stress, turbulent heat flux, and phase change will be introduced, expanding to their numerical models, together with some recent trends of high-tech heat and energy devices.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Surrounding Examples of Transport Phenomena	1	
Governing Equations and Non-Dimensional Parameters	3 ~ 4	
Boundary Layer Flows	2 ~ 3	
External and Internal Flows	1 ~ 2	
Turbulent Phenomena	2 ~ 3	
Topics of Flow and Heat Transfer Mechanism	2 ~ 3	
Estimation on Study Achievement	1	

【Textbook】

【Textbook(supplemental)】 Example: Transport Phenomena (Bird, R.B. et al.)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Condensed Matter Physics**

量子物性物理学

【Code】 10G009 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Thu 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Global Survivability Studies**

グローバル生存学

【Code】 10F113 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Exercise in Practical Scientific English

実践的科学英語演習

【Code】10i045 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】Thu 4th or 5th 【Location】A2-304 【Credits】1

【Restriction】Up to twenty students for each class 【Lecture Form(s)】Seminar 【Language】Japanese and English

【Instructor】Y. Nakayama and M. Nishi

【Course Description】Students learn about the basics of technical writing in English, and learn about and practice the format, style, and mechanics of the scientific research article. Students will also develop skills needed to create and deliver an effective presentation in English. We may restrict the class size to enhance learning. The course is shared by Master ' s and Doctoral Course students.

【Grading】Students are required to submit an initial report and a mid-term report, and make a final presentation in English. Students failing to submit the mid-term report or to make a presentation will be given no credit.

【Course Goals】Students develop basic communication skills needed to work for international organizations through practicing scientific English writing as well as presenting their research in English.

【Course Topics】

Theme	Class number of times	Description
Course Outline and Introduction to Technical Writing	1	Students examine the aim and requirements of the course, and look at the key points for writing correctly, clearly, and concisely. (The class schedule may change without notice.)
Basics of Technical Writing	2	Students learn about the definition and basic rules for technical writing, and look at common mistakes made by non-native writers of English.
Japanese-to-English Translation Practice	2	Students learn about English grammar and practice revising their English writing.
Paragraphs	2	Students learn about paragraphs: the topic sentence and supporting sentences, and techniques for sequencing information in a paragraph.
Format of Research Articles	2	Students learn about the standard format of a research article: the title and abstract
Listening Practice	1	Students practice listening comprehension using videos presenting scientific and technical information.
Presentation Practice	3	Students learn and practice techniques for delivering an effective presentation, and experience asking and answering questions.
Online Learning	2	Writing Paragraphs

【Textbook】No text – all materials are supplied by the teachers.

【Textbook(supplemental)】Yukiko Nakayama, Gijutsu kei Eibun Raithingu Kyohon (Technical Writing Textbook), Japan Society for Technical Communication

Anne M. Coghil and Lorrin R. Garson, The ACS style guide, 3rd, The American Chemical Society

【Prerequisite(s)】Students need to have basic English skills at undergraduate level.

【Independent Study Outside of Class】

【Web Sites】<http://www.glc.t.kyoto-u.ac.jp/ja/study/grad/10d040>

【Additional Information】We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance.

# Introduction to Advanced Material Science and Technology ( English lecture )

## 先端マテリアルサイエンス通論 ( 英語科目 )

【Code】10K001 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Fri 4th 【Location】KatsuraA2-308,Yoshida Research Bldg.No4,-Room3(Distance lectures)

【Credits】First term: 2, Spring term: 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】GL Edu. Center, J. Assoc. Prof., Tadao Mizuno  
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called "high technologies", and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 先端マテリアル講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Stress-Diffusion Coupling in Polymer Gels	1	Because a polymer gel in solvent forms a thermodynamic semi-open system, a mechanical stimulus imposed on the gel induces a thermodynamic response. The outline of this phenomenon is explained by using several examples. (4/10 T. Takigawa)
Modern Organic Synthesis for Material Science	1	The lecture will deliver recent developments in organic synthesis, particularly focusing on catalytic reactions that have revolutionized chemical processes, and their applications in the production of some important pharmaceuticals and organic materials. (4/17 Y. Nakao)
Oxide Magnetic Materials	1	Fundamentals of magnetism and magnetic properties of oxides as well as applications of magnetic oxide materials are described. A brief introduction to recent magnetics-related technologies such as spintronics is also given. (4/24 K. Tanaka)
In Vivo Optical and Photoacoustic Tumor Imaging using Near-infrared Dye-conjugated Amphiphilic Polymers	1	Optical and photoacoustic imaging methods are one of the most powerful and noninvasive techniques with which to visualize organs as well as tumor tissues. In this lecture, students can learn the basic principles of molecular imaging as well as recent progress in this field. (5/8 K. Ohe)
Photofunctional Nanocarbon Materials	1	Photo-functionalization of nanocarbon materials, e.g., fullerenes, carbon nanotubes, and graphenes, using the methodologies of organic synthetic chemistry and their application in photoelectrochemical devices. (5/15 T. Umeyama)
Rheology Control by Associating Polymers	1	Hydrophobically modified water-soluble polymers (associating polymers) have been used as rheology modifiers or thickeners because rheological properties of solutions and dispersions are drastically changed by the addition of small amounts of associating polymers. In this lecture, recent development on the molecular origin of the structure formation and rheological properties of associating polymers will be reviewed. (5/22 T. Koga)
Solar Hydrogen Production using Semiconductor Photocatalyst	1	The development of a clean and renewable energy carrier that does not utilize fossil fuels is a great technological challenge. Photocatalytic water splitting using semiconductor materials has attracted considerable interest due to its potential to cleanly produce H <sub>2</sub> from water by utilizing abundant solar light. In the present lecture, the basis and the recent progress in photocatalytic water splitting will be introduced. (5/29 R. Abe)
Hyperthermophiles and their thermostable biomolecules	1	This lecture will first introduce the diversity and classification of life. It will then focus on hyperthermophiles and their thermostable molecules, such as proteins, nucleic acids and lipids. (6/5 H. Atomi)
Physical Organic Chemistry of Supramolecular Photofunctional Organic Materials	1	This lecture explains interesting behaviors of photofunctional organic materials, such as photochromic compounds and fluorescence dyes, in the aggregated and self-organized state from the viewpoint of physical organic chemistry. (6/12 K. Matsuda)
Production of Advanced Materials by Micro Chemical Plants	1	This lecture will concentrate on the following topics related to the micro chemical processes. 1) Feature of micro devices, 2) Possibility of using micro systems for real production, 3) Design problems of micro chemical plants, 4) Control of micro chemical plants, 5) Blockage detection of parallelized micro plants, 6) Future direction of the research on micro chemical plants. (6/19 S. Hasebe)
Directed Self-Assembly (DSA) of Block Copolymers	1	Recently, Directed Self-Assembly (DSA) technology of block copolymers has received a lot of attention in the field of semiconductor research. In this lecture, the fundamentals of microphase separation of block copolymers and the application of DSA to lithographic technologies will be reviewed. (6/26 T. Koga)
High-temperature superconductor as a playground for the macroscopic quantum phenomena	1	High temperature superconductors have attracted much attention to their emerging mechanism and applications. They are also quite peculiar for playgrounds for superconducting properties as macroscopic quantum phenomena. In this lecture, quantum phenomena found in high temperature superconductors and their applications are discussed. (7/3 I. Kakeya)
Introduction to Nuclear Materials	1	Nuclear materials are designed for good performance in irradiation field of neutron and high-energy particles. Fundamentals and some examples of nuclear reactions with these particles will be talked. (7/10 I. Takagi)
Materials Processing using external fields for microstructure control	1	Properties of materials are not simply determined by atomic structure and chemical composition. Microstructure (crystal grain size, crystallographic orientation and so on) significantly influences the properties. Not a few techniques have been developed for controlling the microstructure. Materials processing using external fields will be demonstrated in this class. (7/17 H. Yasuda)
Electrodeposition and Electroless Deposition for Materials Processing	1	(1) Fundamentals chemistry, electrochemistry, and thermodynamics, and (2) applications of electrodeposition and electroless deposition for materials processing. (7/24 K. Murase)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Check the notice on the bulletin board.

Students who take Spring term (Lecture code 10H012) should attend first 11 lectures.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.



**Dimensional Control and Micro-Nano Systems**

ディメンジョンの制御とナノ・マイクロ化学

【Code】10H403 【Course Year】1st year - 5th year 【Term】 【Class day &amp; Period】 【Location】A2-302 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Molecular Function and Composite-Assembly Function

分子機能と複合・集積機能

【Code】10H404 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 1st 【Location】A2-302

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】H.Imahori,S.Kimura,Y.Tsuji,S.Seki,A.Ito,H.Kaji,T.Sato,K.Akagi,H.Ohkita,Y.Tsuji,K.Matsuda,

【Course Description】Principles and their examples of revealing molecular function will be described based on molecular design. We also focus on guidelines of molecular design and their representative examples to achieve function of molecular composites and assemblies.

【Grading】The grading will be done on a basis of your presence and assignments.

【Course Goals】The goal of this course is to acquire abilities of proposing and performing research plans with regard to functions of molecular composites and assemblies by learning principles and their examples of revealing their molecular functions.

【Course Topics】

Theme	Class number of times	Description
Molecular function and composite-assembly function relating to light	1	This lecture describes photosynthesis and artificial photosynthesis as examples of molecular function and composite-assembly function relating to light. Organic photonics and electronics including molecular photovoltaics are also highlighted as potential practical applications (Imahori).
Properties and measurements of molecular assemblies	2	i) Thermodynamic backgrounds of phases and assembly of functional organic molecules, ii) Electronic structure of molecular aggregates and conjugated polymers, iii) Measurements of electronic conductivity and dielectric properties: the principles and application to the functional molecular assembly and aggregates (Seki).
Molecular design for efficient catalysis	2	This lecture describes several important ideas for development of highly efficient organotransition metal catalysts in green and sustainable chemistry. Highly efficient addition reactions and carbon – carbon bond forming reactions employing carbon dioxide are highlighted (Tsuji). Reference: J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.
Fundamentals and recent developments of organic LEDs	2	This lecture describes organic devices, especially organic light-emitting diodes, from the fundamentals to recent developments (Kaji).
Photovoltaic conversion based on molecular assembly of organic semiconductors	2	This lecture gives an introduction to polymer solar cells. It starts by introducing various conjugated polymers as semiconductor, which are promising materials for organic optoelectronics such as organic light-emitting diode displays and organic photovoltaic cells. The fundamental mechanism of organic solar cells is then briefly explained to clarify how self-assembling structures of semiconducting materials impact on the photovoltaic performance. Recent progress in this field is overviewed and several challenging studies are also introduced (Ohkita).
Theoretical design for functional molecules from the view of electron-vibration interactions	2	This lecture describes theoretical design principles for highly efficient emitting and carrier-transporting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings) (T. Sato).

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】Knowledge of an undergraduate level of chemistry as well as of English, especially listening and reading, is required.

【Independent Study Outside of Class】

【Web Sites】None

【Additional Information】This course has been changed from every two years to every year since 2015. Prof. Imahori has been a head of this course since 2009. A student who entered the course in 2014 and needs 2 credits rather than 1.5 credits should contact Prof. Imahori to get information on it.

**Physical Chemistry and Analytical Techniques of Complex Systems**

複合系の物理化学と解析技術

【Code】 10H407 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Mon 5th

【Location】 A2-304 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 Japanese

【Instructor】 K.Tanaka,T.Takigawa,T.Sakka,T  
Ohtsuki,T.Tanaka.H.Watanabe.T.Yoshizaki,T.Koga,T.Kanaya,R.Yamamoto,M.Miyahara,

【Course Description】 This course focuses on fundamentals of physical chemistry for a quantitative understanding of structure, reaction, and properties of matters in complex systems. Analytical techniques including theoretical, numerical, and experimental approaches for clarification of the phenomena in complex systems are also introduced.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Frontiers in the Field of Chemical Biology and Biological Chemistry**

化学から生物へ 生物から化学へ

**【Code】** 10H409 **【Course Year】** Master and Doctor Course **【Term】** 2nd term **【Class day & Period】** Tue 5th**【Location】** A2-302 **【Credits】** **【Restriction】** No Restriction **【Lecture Form(s)】** Relay Lecture**【Language】** English **【Instructor】** K. Akiyoshi, M. Shirakawa, Y. Tabata, I. Hamachi, Y. Mori, M. Umeda, H. Atomi,**【Course Description】** In the cutting-edge of research fields, chemistry and biology are being closely related each other. In this class, progress in such interdisciplinary areas and topics including natural products, biophysics, bioimaging, biomaterials, regenerative medicine, microbiology, thermal biology, structural biology, chemical biology, molecular physiology and others, are briefly explained and discussed.**【Grading】** Evaluation will be conducted by attendance and scores for exercises and problems that each lecturer charges in his topics**【Course Goals】** Students will be able to understand recent progress and trends in broad interdisciplinary areas between biology and chemistry and make their own ideas in these research fields from a viewpoint of individual researchers and engineers.**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
10/6-1/12	11	The guidance will be conducted at the first day of this class (Oct. 6th, 2015).

**【Textbook】****【Textbook(supplemental)】****【Prerequisite(s)】** Fundamentals in chemistry, biochemistry, biology, and materials science.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】** The credit for MS2 students will be guided in detail at the first day.

**Advances in Rechargeable Batteries**

先端二次電池

【Code】 10H415 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】

【Location】 A2-303 【Credits】 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2回	
	3回	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Integrated Chemical Synthesis

## 集積合成化学

【Code】10H418 【Course Year】Master and Doctor Course 【Term】every two years, open in H27 【Class day & Period】intensive course 【Location】A2-302 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Department of Synthetic Chemistry and Biological Chemistry, Professor, Jun-ichi Yoshida  
Department of Synthetic Chemistry and Biological Chemistry, Lecturer, Aiichiro Nagaki

【Course Description】The course is aimed at developing a deeper understanding chemical reactions by taking advantage of the characteristic features of flow microreactorspace integration of reactions using flow microreactors. The course is not a compilation of all fields of flow microreactor synthesis, but it focuses on high-resolution reaction time control and fast micromixing. The topics discussed in this book would be sufficient to interest a wide range of students in this fascinating field of chemistry and to encourage them to try chemical synthesis using flow microreactors.

【Grading】examination

【Course Goals】To understand characteristic feautres of flow microreactor reactions and to get ability to design integrated synthesis using flow microreactors.

【Course Topics】

Theme	Class number of times	Description
Departure from Flask Chemistry	1	1.1 Introduction 1.2 Flow Reactors and Batch Reactors 1.3 Fluid Dynamics 1.4 Residence Time 1.5 Relationship between Residence Time and Reaction Time 1.6 How Reaction Proceeds in Batch Reactor 1.7 How Reaction Proceeds in Flow Reactor 1.8 How to Set Residence Time 1.9 Looking Forward
Controlling Residence Time	1	2.1 Introduction 2.2 Monitoring the Progress of a Reaction in a Flow Reactors: Inline Analysis 2.3 Monitoring the Progress of a Reaction in a Flow Reactors: Quench Flow Method 2.4 Generation and Reactions of Oxiranylithiums: An Example of Quench Flow Method 2.5 General Consideration on Controlling Reactions Involving Unstable Intermediates 2.6 Temperature-Residence Time Mapping
Fast Micromixing	1	3.1 Introduction 3.2 What Is Mixing? 3.3 Mixing by Stirring 3.4 Mixing Using Micromixer 3.5 Measuring Mixing Efficiency or Speed
Use of Short-lived Reactive Specie	1	4.1 Introduction 4.2 Generation of Organometallic Species Containing Alkoxy carbonyl Groups 4.3 Decreasing the Reactivity of Organometallic Reagents to Increase Compatibility 4.4 Br - Li Exchange Reactions of Alkyl o-Bromobenzoates in a Batch Reactor 4.5 Br - Li Exchange Reactions of Alkyl o-Bromobenzoates in a Flow Microreactor 4.6 Br - Li Exchange Reactions of Alkyl p-Bromobenzoates in a Flow Microreactor 4.7 I - Li Exchange Reactions of Alkyl p-Iodobenzoates in a Flow Microreactor 4.8 Looking Forward
Protecting-group-free Synthesis	1	5.1 Introduction 5.2 Protecting Group 5.3 Reactions of Organometallic Reagents with Carbonyl Groups 5.4 Generation and Reaction of Aryllithium Species Bearing Ketone Carbonyl Groups
Controlling Isomerization	1	6.1 Introduction 6.2 Controlling Positional Isomers 6.3 Controlling Diastereomers 6.4 Controlling Stereoisomers (Enantiomers)
Controlling Competitive Consecutive Reactions	1	7.1 Introduction 7.2 Factors Determining Selectivity in Chemical Reactions 7.3 Competitive Consecutive Reactions 7.4 Disguised Chemical Selectivity 7.5 Controlling Selectivity of Friedel-Crafts Reactions Using Micromixing 7.6 CFD Simulations 7.7 Controlling Other Reactions Using Micromixing
Flash Chemistry	1	8.1 Introduction 8.2 What Is Flash Chemistry 8.3 Some Examples of Flash Chemistry 8.4 Scientific Merits 8.5 High Productivity and Impact on Industry
Space Integration of Reactions	1	9.1 Introduction 9.2 Integrating Reactions 9.3 Synthesizing o - Disubstituted Benzenes by Space Integration of Two Organolithium Reactions 9.4 Synthesizing TAC-101 by Integration of Three Organolithium Reactions 9.5 Space Integration of Halogen-lithium Exchange Reaction and Cross-Coupling Reaction
Polymerization	1	10.1 Introduction 10.2 Controlling Competitive Consecutive Reactions and Chain-Growth Polymerization 10.3 Chemistry of Cationic Polymerization 10.4 Flash Cationic Polymerization 10.5 Flash Anionic Polymerization 10.6 Other Polymerizations Using Flow Microreactor System
Summary and Outlook	1	

【Textbook】none

【Textbook(supplemental)】

【Prerequisite(s)】none

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Integrated Chemical Processes

### 集積化学プロセス

【Code】 10H420 【Course Year】 Master and Doctor Course 【Term】 Spring 【Class day & Period】 Mon 2nd  
 【Location】 A2-302 【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English  
 【Instructor】 Professor Kazuhiro Mae, Department of Chemical Engineering

Professor Shinji Hasebe, Department of Chemical Engineering

【Course Description】 The basic concept of unit operation using micro space is explained. Then, the design and control strategies of new micro chemical plants are lectured.

【Grading】 Coursework will be graded based on reports, quiz in lecture, and examination.

【Course Goals】 A deeper understanding of the following points is the target of this course: 1) Understand the method of quantitative treatment of transport phenomena and mixing in micro space, 2) Based on the fundamental knowledge of micro chemical engineering explained above, acquire the skill of designing various types of micro reactors and micro mixers, 3) Understand the difference of micro chemical processes and conventional chemical processes, and acquire the skills of designing the operation and control systems.

#### 【Course Topics】

Theme	Class number of times	Description
What is microreactor?	1	Preliminary exercises (for understanding students' knowledge level of chemical engineering). Explain merits and utilization concepts of microreactor with illustrating typical microreactor structure.
Transport phenomena in micro space	2	Introduce how to treat quantitatively the transport phenomena in micro channel. Especially, explain the basic and modelling for heat transfer in micro channel. Finally, master the concept and design of micro heat exchanger.
Micro mixing	1	Starting from the logic of micro mixing, explain the design and operation factors of micro mixer with illustrating various micro mixers. Next, introduce the concept of micro mixing of immiscible fluids (liquid/liquid and gas/liquid) for strict control of emulsion and bubble.
Micro reaction engineering	3	Introduce microreactors for organic synthesis, nano-particle production device, catalytic microreactor, and segmented flow microreactor with illustrating their drastic effect for quality control of products. Next, explain the methodology of design each reactor and its application.
Design of micro chemical process	2	The design method considering the feature of micro chemical plant is explained. Especially, the treatment as a system and the numbering-up methods are discussed.
Operation and control of micro chemical processes	2	The difference between the control scheme of the conventional plants and that of the micro plants is explained. Then, the operation and control methods of numbering-up process and the fault detection method of blocked device are explained.

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for calculus, transport phenomena, chemical reaction engineering, process control are required, but we consider to be able to understand for the students with no prior knowledge by introducing reference books.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Since contact matters will be notified at KULASIS, register your e-mail address to KULASIS

## Microbiology and Biotechnology

Microbiology and Biotechnology

【Code】10H817 【Course Year】Master and Doctor Course 【Term】Autumn 【Class day & Period】Wed 2nd  
 【Location】A2-308 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Haruyuki Atomi, Tamotsu Kanai

【Course Description】 This lecture will introduce the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. Commonly used tools in the fields of biochemistry, molecular biology and genetics will also be discussed. In addition, methods to utilize cells and their enzymes in biotechnology will be introduced. Lectures will be given in English, with the aim to improve communication/discussion skills.

【Grading】 Grading will be based on presentations (60%) and attendance (40%).

【Course Goals】 Basic knowledge on the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. An understanding of the commonly used tools in the fields of biochemistry, molecular biology and genetics as well as methods to utilize cells and their enzymes in biotechnology. Lectures will be given in English, with the aim to improve communication/discussion skills.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Diversity of life, classification of organisms, structure and function of fundamental biomolecules.
Basic mechanisms to sustain life	3	Strategies to conserve energy, biosynthesis, cell division, cell differentiation.
Strategies to adapt to environmental conditions	2	Effect of environmental conditions on cells and biomolecules, thermophiles, acidophiles and their enzymes.
Protein engineering	2	Methods to study enzymes and enzyme reactions, methods to enhance their performance.
Cell engineering	2	Methods utilized in metabolic engineering, cell surface engineering, synthetic biology.
Topic discussion	1	Particular topics will be chosen for discussion

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Green Chemical Processing**

グリーンケミストリー &amp; グリーンプロセスの設計

【Code】 10H421 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 1st

【Location】 A2-303 【Credits】 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	7	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Environmental-friendly Technology for Sound Material Cycle**

環境資源循環技術

【Code】 10H424 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 3rd

【Location】 C1-192 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,,,,,

【Course Description】 Global warming, ecosystem crisis, and depletion of natural resources are of great concern today. To solve these problems, we have to build the sustainable society where low carbon dioxide emission, low environmental burdens, and the reduction of wastes by recycling are realized. It is possible to utilize municipal wastes, wastewaters, and unused biomass as resources instead of the natural resources used at present. Recycling-oriented technologies that enable sustainable utilization of those wastes and the concept to develop those technologies are introduced.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Laboratory and Exercise on Materials Engineering and Chemistry I**

物質機能・変換科学特別実験及演習

【Code】10W432 【Course Year】Master 1st 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Laboratory and Exercise on Materials Engineering and Chemistry I I**

物質機能・変換科学特別実験及演習

【Code】10W433 【Course Year】Master 1st 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Laboratory and Exercise on Materials Engineering and Chemistry III**

物質機能・変換科学特別実験及演習

【Code】10W434 【Course Year】Master 2nd 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Laboratory and Exercise on Materials Engineering and Chemistry IV**

物質機能・変換科学特別実験及演習

【Code】10W435 【Course Year】Master 2nd 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry I**

物質機能・変換科学特別セミナー

【Code】 10W437 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry II**

物質機能・変換科学特別セミナー

【Code】10W438 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry III**

物質機能・変換科学特別セミナー

【Code】 10W439 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry IV**

物質機能・変換科学特別セミナー

【Code】 10W440 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry V**

物質機能・変換科学特別セミナー

【Code】 10W441 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Materials Engineering and Chemistry VI**

物質機能・変換科学特別セミナー

【Code】10W442 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemical Reaction Engineering, Adv. ( English lecture )**

Chemical Reaction Engineering, Adv.

**【Code】** 10H009 **【Course Year】** Master and Doctor Course **【Term】** **【Class day & Period】** Fri 2nd **【Location】** A2-305**【Credits】** **【Restriction】** **【Lecture Form(s)】** **【Language】** English **【Instructor】** Kawase, (EPRC) Nakagawa**【Course Description】** This lecture is given in English. The following contents are covered: - Kinetic analysis of gas-solid-catalyst reaction, gas-solid reaction, and CVD reaction, - Operation and design of reactors for gas-solid-catalyst and gas-solid reactions, and - Industrial reactors including fixed bed, fluidized bed, moving bed, simulated moving bed, and stirred tank types.**【Grading】** Based on the result of examination at the end of term and the results of quizzes and reports imposed every week.**【Course Goals】** To understand kinetic analysis of chemical reactions utilized in the industry and procedure to design and operate industrial reactors.**【Course Topics】**

<b>Theme</b>	<b>Class number of times</b>	<b>Description</b>
Gas-solid-catalyst reaction (1) Fundamentals	1	Commercial catalysts and industrial gas-solid-catalyst reactions are overviewed. Chemical reaction engineering fundamentals of the gas-solid-catalyst reaction is explained.
Gas-solid-catalyst reaction (2) Generalized effectiveness factor and selectivity in complex reactions	1	The generalized effectiveness factor and the selectivity affected by mass transfer are explained.
Gas-solid-catalyst reaction (3) Deactivation and regeneration of catalyst	2	Deactivation mechanisms of solid catalysts are overviewed. The deactivation and consequent change in selectivity are explained in terms of the decay function and specific activity.
Gas-solid-catalyst reaction (4) Design and operation of industrial catalytic reactors	1	Industrial catalytic reactors including fixed-bed and fluidized-bed reactors are overviewed. Design and operation of these reactors including thermal stability are explained.
Liquid-solid-catalyst reaction -- Simulated moving bed reactor	1	Concept and applications of simulated moving bed reactor are explained. Model-based analysis of simulated moving bed reactor is explained.
CVD reaction	2	Fundamentals of CVD reactions are explained from chemical reaction engineering view point. Kinetic analysis of CVD is described. Reaction models including elementary reaction model and overall reaction model are derived and applied to some examples.
Gas-solid reaction (1) Kinetic analysis	2	Kinetic measurement and analysis of complicated gas-solid reactions, particularly coal pyrolysis, are explained with the first-order reaction model to the distributed activation energy model (DAEM).
Gas-solid reaction (2) Kinetic analysis of gas-solid reaction	1	Concepts and derivation of the reaction models including the grain model and the random-pore model are explained. Application of the models to coal gasification is overviewed.

**【Textbook】** Prints are hand out at the class.**【Textbook(supplemental)】****【Prerequisite(s)】** Needs knowledge of chemical reaction engineering including heterogeneous reactions.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

**Advanced Topics in Transport Phenomena ( English lecture )**

Advanced Topics in Transport Phenomena

【Code】 10H003 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day &amp; Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

## 【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlter, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Mathematics and Numerical Computing**

Mathematics and Numerical Computing

【Code】 10H444 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**English for Debate and Communications**

English for Debate and Communications

【Code】 10H446 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Japan Gateway Project Special Seminar**

JGP セミナー

【Code】 10P448 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day &amp; Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor  
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

## 【Course Topics】

Theme	Class number of times	Description
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【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

**Japan Gateway Project Special Seminar**

JGP セミナー

【Code】 10P450 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day &amp; Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor  
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

## 【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

**Japan Gateway Project Seminar**

JGP セミナー

【Code】 10P452 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day &amp; Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor  
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

## 【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

**Japan Gateway Project Special Seminar**

JGP セミナー

【Code】10P454 【Course Year】Master and Doctor Course 【Term】2016/ 1st+2nd term 【Class day &amp; Period】

【Location】 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

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【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Japan Gateway Project Seminar**

JGP セミナー

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【Location】 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Japan Gateway Project International Internship

JGP・インターンシップ I (短期)

【Code】 10P458 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day & Period】

【Location】 【Credits】 0.5 【Restriction】 Limited to the students in Pre-super global course

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members of Chemistry and Chemical Engineering Subunit in JGP

【Course Description】 At the overseas cooperation university in JGP project, a research-based internship of one month is executed. Through the internship, study how to proceed the research at the advanced universities, and improve the English communication ability.

【Grading】 The content of presentation and the presentation skill are evaluated at the seminar which will be executed after the internship.

【Course Goals】 This course aims to understand the way of managing the research at the foreign university, and obtain the communication skills by which they can argue the details of research with foreign researchers.

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 By the limitation of budget for each year, the number of students will be restricted.

**Japan Gateway Project International Internship II**

JGP・インターンシップ (中期)

【Code】 10H460 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】

【Location】 【Credits】 1 【Restriction】 Limited to the students in Pre-super global course

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members of Chemistry and Chemical Engineering Subunit in JGP

【Course Description】 At the overseas cooperation university in JGP project, a research-based internship of two months is executed. Through the internship, study how to proceed the research at the advanced universities, and improve the English communication ability.

【Grading】 The content of presentation and the presentation skill are evaluated at the seminar which will be executed after the internship.

【Course Goals】 This course aims to understand the way of managing the research at the foreign university, and obtain the communication skills by which they can argue the details of research with foreign researchers.

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 By the limitation of budget for each year, the number of students will be restricted.

## Japan Gateway Project International Internship

JGP・インターンシップ (長期)

【Code】 10H462 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day & Period】

【Location】 【Credits】 1.5 【Restriction】 Limited to the students in Pre-super global course

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members of Chemistry and Chemical Engineering Subunit in JGP

【Course Description】 At the overseas cooperation university in JGP project, a research-based internship of more than three months is executed. Through the internship, cultivate the abilities of communication with foreign researchers, management of a research, and writing research papers.

【Grading】 The content of presentation and the presentation skill are evaluated at the seminar which will be executed after the internship.

【Course Goals】 This course aims to acquire the skills of communicating with foreign researchers, managing the research, and writing academic papers.

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 By the limitation of budget for each year, the number of students will be restricted.



# Introduction to Advanced Material Science and Technology ( English lecture )

## 先端マテリアルサイエンス通論 ( 英語科目 )

【Code】10K001 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Fri 4th 【Location】KatsuraA2-308,Yoshida Research Bldg.No4,-Room3(Distance lectures)

【Credits】First term: 2, Spring term: 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】GL Edu. Center, J. Assoc. Prof., Tadao Mizuno  
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called "high technologies", and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 先端マテリアル講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Stress-Diffusion Coupling in Polymer Gels	1	Because a polymer gel in solvent forms a thermodynamic semi-open system, a mechanical stimulus imposed on the gel induces a thermodynamic response. The outline of this phenomenon is explained by using several examples. (4/10 T. Takigawa)
Modern Organic Synthesis for Material Science	1	The lecture will deliver recent developments in organic synthesis, particularly focusing on catalytic reactions that have revolutionized chemical processes, and their applications in the production of some important pharmaceuticals and organic materials. (4/17 Y. Nakao)
Oxide Magnetic Materials	1	Fundamentals of magnetism and magnetic properties of oxides as well as applications of magnetic oxide materials are described. A brief introduction to recent magnetics-related technologies such as spintronics is also given. (4/24 K. Tanaka)
In Vivo Optical and Photoacoustic Tumor Imaging using Near-infrared Dye-conjugated Amphiphilic Polymers	1	Optical and photoacoustic imaging methods are one of the most powerful and noninvasive techniques with which to visualize organs as well as tumor tissues. In this lecture, students can learn the basic principles of molecular imaging as well as recent progress in this field. (5/8 K. Ohe)
Photofunctional Nanocarbon Materials	1	Photo-functionalization of nanocarbon materials, e.g., fullerenes, carbon nanotubes, and graphenes, using the methodologies of organic synthetic chemistry and their application in photoelectrochemical devices. (5/15 T. Umeyama)
Rheology Control by Associating Polymers	1	Hydrophobically modified water-soluble polymers (associating polymers) have been used as rheology modifiers or thickeners because rheological properties of solutions and dispersions are drastically changed by the addition of small amounts of associating polymers. In this lecture, recent development on the molecular origin of the structure formation and rheological properties of associating polymers will be reviewed. (5/22 T. Koga)
Solar Hydrogen Production using Semiconductor Photocatalyst	1	The development of a clean and renewable energy carrier that does not utilize fossil fuels is a great technological challenge. Photocatalytic water splitting using semiconductor materials has attracted considerable interest due to its potential to cleanly produce H <sub>2</sub> from water by utilizing abundant solar light. In the present lecture, the basis and the recent progress in photocatalytic water splitting will be introduced. (5/29 R. Abe)
Hyperthermophiles and their thermostable biomolecules	1	This lecture will first introduce the diversity and classification of life. It will then focus on hyperthermophiles and their thermostable molecules, such as proteins, nucleic acids and lipids. (6/5 H. Atomi)
Physical Organic Chemistry of Supramolecular Photofunctional Organic Materials	1	This lecture explains interesting behaviors of photofunctional organic materials, such as photochromic compounds and fluorescence dyes, in the aggregated and self-organized state from the viewpoint of physical organic chemistry. (6/12 K. Matsuda)
Production of Advanced Materials by Micro Chemical Plants	1	This lecture will concentrate on the following topics related to the micro chemical processes. 1) Feature of micro devices, 2) Possibility of using micro systems for real production, 3) Design problems of micro chemical plants, 4) Control of micro chemical plants, 5) Blockage detection of parallelized micro plants, 6) Future direction of the research on micro chemical plants. (6/19 S. Hasebe)
Directed Self-Assembly (DSA) of Block Copolymers	1	Recently, Directed Self-Assembly (DSA) technology of block copolymers has received a lot of attention in the field of semiconductor research. In this lecture, the fundamentals of microphase separation of block copolymers and the application of DSA to lithographic technologies will be reviewed. (6/26 T. Koga)
High-temperature superconductor as a playground for the macroscopic quantum phenomena	1	High temperature superconductors have attracted much attention to their emerging mechanism and applications. They are also quite peculiar for playgrounds for superconducting properties as macroscopic quantum phenomena. In this lecture, quantum phenomena found in high temperature superconductors and their applications are discussed. (7/3 I. Kakeya)
Introduction to Nuclear Materials	1	Nuclear materials are designed for good performance in irradiation field of neutron and high-energy particles. Fundamentals and some examples of nuclear reactions with these particles will be talked. (7/10 I. Takagi)
Materials Processing using external fields for microstructure control	1	Properties of materials are not simply determined by atomic structure and chemical composition. Microstructure (crystal grain size, crystallographic orientation and so on) significantly influences the properties. Not a few techniques have been developed for controlling the microstructure. Materials processing using external fields will be demonstrated in this class. (7/17 H. Yasuda)
Electrodeposition and Electroless Deposition for Materials Processing	1	(1) Fundamentals chemistry, electrochemistry, and thermodynamics, and (2) applications of electrodeposition and electroless deposition for materials processing. (7/24 K. Murase)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Check the notice on the bulletin board.

Students who take Spring term (Lecture code 10H012) should attend first 11 lectures.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.





**Professional Scientific Presentation Exercises ( English lecture )**

科学技術者のためのプレゼンテーション演習 ( 英語科目 )

【Code】 10i041 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1

【Restriction】 The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】 Reports, class activity, presentation

【Course Goals】 This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 13th, and the 1st lesson is repeated on April 20th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

**Advanced Engineering and Economy ( English lecture )**

工学と経済 ( 上級 )( 英語科目 )

【Code】10i042 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 5th 【Location】B-Cluster 2F Seminar Room

【Credits】2 【Restriction】The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】Lectures, Group works&amp;tasks 【Language】English

【Instructor】Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】Engineering economics plays central role in any industrial engineering project. For an engineer, it is important to apply the engineering know-how with the economic analysis skills to obtain the best available materials, methods, devices, etc. in the most economical way. This course is aimed to teach engineering students the basic economic methods to manage economically an engineering project. In addition, the report writing on various engineering economic issues prepares to write reports in a professional form. The lab sessions are meant for the verbal skills improvement as well as improvement of analytical thinking. The topics are of current relevant topics Small-group brain-storming method is used. The exercise sessions cover the use of Ms-Excel for various quantitative economic analyses.

【Grading】Final test, reports, class activity

【Course Goals】This course is aimed to strengthen engineering students' skills in economics. The course concept is to teach students selectively those subjects which serve as major tools to solve economic tasks in engineering environment. The reports and lab sessions provide students stimulating and analytical thinking requiring tasks, and presentation skills training is an important part of this course.

【Course Topics】

Theme	Class number of times	Description
Student orientation and Introduction to engineering economy	1	
Cost concepts and design economics	1	
Cost estimation techniques	1	
The time value of money	1	
Evaluating a single project	1	
Comparison and selection among alternatives	1	
Depreciation and income taxes	1	
Price changes and exchange rates	1	
Replacement analysis	1	
Evaluating projects with the benefit-cost ratio method	1	
Breakeven and sensitivity analysis	1	
Probabilistic risk analysis	1	
The capital budgeting process	1	
Decision making considering multiattributes	1	
Final test	1	

Additionally, students will submit five reports during the course on given engineering economy subjects. Also, required are the five lab participations (ca.60 min/each) for each student. Additionally, three exercise sessions (ca.60 min/each), where use of Ms-Excel will be practiced for solving various engineering economy tasks, should be completed

【Textbook】Engineering Economy 15th ed. William G. Sullivan (2011)

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】-This course is highly recommended for those who attend " Engineering Project Management" course , Small group working method

【Independent Study Outside of Class】

【Web Sites】The web-site is listed in the home page of the GL education center.

【Additional Information】Students are requested to check in advance whether the credits of this course are counted as the units for graduation requirement at department level. The course starts on Apr.12th.

**Engineering Project Management (English lecture)**

エンジニアリングプロジェクトマネジメント (英語科目)

【Code】 10i047 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 5th 【Location】 B-Cluster 2F Seminar Room

【Credits】 1 【Restriction】 【Lecture Form(s)】 Lectures, Group works&amp;tasks 【Language】 English

【Instructor】 Lintuluoto, Oishi, Takatori, Nishi, Mizuno, Tanaka

【Course Description】 The purpose of this course is to teach the basic skills needed for expressing and initiating ideas, and presenting information in successful international engineering group work. The course provides simulations for students in group managing and decision making in international engineering teams. International teamwork ethics subjects for successful engineering project will be practiced. The course consists of lectures, case studies, the invited lecture from an industry representative and the final examination. Also, a project report exercise is included in this course.

The course is basically designed for doctor course (DC) students, both Japanese and foreign nationals. If place are available they may be given to master course students.

【Grading】 Report, class activity, presentation

【Course Goals】 This course is the pre-course for Engineering Project Management II which will be held in the second semester. Students will learn project management tools, apply project strategies and perform qualitative risk analyses. Also students will learn how to carry out projects with group members from various countries and engineering fields.

【Course Topics】

Theme	Class number of times	Description
Introduction to the course	1	4/11 The introduction to the course and preliminary knowledge about the engineering project management will be given. (All)
Strategy Viewpoints in Engineering Projects	1	4/18 (Oishi)
Project Management	1	4/25 I (Lintuluoto)
Management of abroad dispatched project	1	5/8 Through an abroad dispatched project of Graduate School of Engineering, Kyoto University, the development and management of the project in University will be given. (Mizuno)
Project management	1	5/15 II (Lintuluoto)
Design thinking	1	5/22 (Takatori)
Public governance of engineering project	1	5/29 The lecturer will be invited from the Ministry of land, Infrastructure, Transport and Tourism. Mr. Wako will talk about Public governance of engineering project (Mizuno)
Risk Identification and Assessment for Engineers	1	6/5 (Nishi)
Risk Identification and Assessment for Engineers	1	6/12 (Nishi)
Engineering project presentation	1	6/19 (Takatori)
Leadership skills	1	6/26 I (Tanaka)
Leadership skills	1	7/3 II (Tanaka)
Special Lecture from Industry	1	7/10 The lecturer will be invited from JGC Corporation (日揮株式会社). Mr. Kumagai will talk about the characteristics of the management of the project for different phases through a project in a foreign country. (Mizuno)
Special Lecture from Industry	1	7/17 The lecturer will be invited from a company. (Mizuno)
Review of the course	1	7/24 Review of the course

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】 ‘ -This course is recommended for those who later intend to attend “ Engineering Project Management II ” .

-Highly interactive lessons (discussion), Small group work methodologies.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department. The course starts on Apr. 10th.

**Engineering Project Management (English lecture)**

エンジニアリングプロジェクトマネジメント (英語科目)

【Code】 10i048 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1 【Restriction】 Student number will be limited.

【Lecture Form(s)】 Semina r 【Language】 English 【Instructor】 Lintuluoto , Mizuno , Oishi, Takatori, Nishi,

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, group leadership, and international communication which they learned in the course of "Engineering Project Management I" to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work and a few intermediate discussions. The course will be held 6 weeks for group work, and two (2) intermediate discussions, project presentation to a wide audience, and a written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

## 【Course Topics】

Theme	Class number of times	Description
Guidance	1	
Group work I	3	
Group work II		
Intermediate discussion I	1	
Group work III	4	
Group work IV		
Intermediate discussion II	1	
Group work V	4	
Group work VI		
Project presentation and discussion	1	

Each project team may freely schedule the group work within the given time frame. In addition to "Intermediate discussion" sessions, the course instructors are available if any such need arises.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Complete the course "Engineering Project Management I" in the 1st term.

-Attendance on "Advanced Engineering Economics" course in the 1st term is strongly recommended.

-Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

**Internship**

産学連携研究型インターンシップ

【Code】10i009 【Course Year】Master and Doctor Course 【Term】 【Class day &amp; Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Instrumental Analysis, Adv.**

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Instrumental Analysis, Adv.**

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Exercise in Practical Scientific English**

実践的科学英語演習

【Code】10i045 【Course Year】Master and Doctor Course 【Term】1st term

【Class day &amp; Period】Thu 4th or 5th 【Location】A2-304 【Credits】1

【Restriction】Up to twenty students for each class 【Lecture Form(s)】Seminar 【Language】Japanese and English

【Instructor】Y. Nakayama and M. Nishi

【Course Description】Students learn about the basics of technical writing in English, and learn about and practice the format, style, and mechanics of the scientific research article. Students will also develop skills needed to create and deliver an effective presentation in English. We may restrict the class size to enhance learning. The course is shared by Master ' s and Doctoral Course students.

【Grading】Students are required to submit an initial report and a mid-term report, and make a final presentation in English. Students failing to submit the mid-term report or to make a presentation will be given no credit.

【Course Goals】Students develop basic communication skills needed to work for international organizations through practicing scientific English writing as well as presenting their research in English.

## 【Course Topics】

Theme	Class number of times	Description
Course Outline and Introduction to Technical Writing	1	Students examine the aim and requirements of the course, and look at the key points for writing correctly, clearly, and concisely. (The class schedule may change without notice.)
Basics of Technical Writing	2	Students learn about the definition and basic rules for technical writing, and look at common mistakes made by non-native writers of English.
Japanese-to-English Translation Practice	2	Students learn about English grammar and practice revising their English writing.
Paragraphs	2	Students learn about paragraphs: the topic sentence and supporting sentences, and techniques for sequencing information in a paragraph.
Format of Research Articles	2	Students learn about the standard format of a research article: the title and abstract
Listening Practice	1	Students practice listening comprehension using videos presenting scientific and technical information.
Presentation Practice	3	Students learn and practice techniques for delivering an effective presentation, and experience asking and answering questions.
Online Learning	2	Writing Paragraphs

【Textbook】No text – all materials are supplied by the teachers.

【Textbook(supplemental)】Yukiko Nakayama, Gijutsu kei Eibun Raithingu Kyohon (Technical Writing Textbook), Japan Society for Technical Communication

Anne M. Coghil and Lorrin R. Garson, The ACS style guide, 3rd, The American Chemical Society

【Prerequisite(s)】Students need to have basic English skills at undergraduate level.

【Independent Study Outside of Class】

【Web Sites】<http://www.glc.t.kyoto-u.ac.jp/ja/study/grad/10d040>

【Additional Information】We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance.

**Experimental Integrated Chemical Systems**

集積化学システム

【Code】10H459 【Course Year】Master and Doctor Course 【Term】 【Class day &amp; Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 J.Yoshida,S.Hasebe,K.Mae,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to Biomedical Engineering**

医工学基礎

【Code】10W603 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to Quantum Science**

基礎量子科学

【Code】 10C070 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	9	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Design for Biomedical and Pharmaceutical Applications**

医薬用高分子設計学

【Code】10D636 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 2nd

【Location】A2-307 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	1	
	1	
	1	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Introduction to the Design and Implementation of Micro-Systems

微小電気機械システム創製学

【Code】 10V201 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 C3-Lecture room 1 or 3 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture and Pactice 【Language】 English

【Instructor】 O. Tabata,H. Kotera,T. Tsuchiya,R. Yokokawa,

【Course Description】 This is a joint lecture with Hong Kong University of Science and Technology (HKUST). A team consists of two students from each University work together to fullfill the assignment (design a microsystem) through paper survey, analysis,design, and presentation. A student can acquire not only the basic knowledge of a microsystem, but also comprehensive ability of English such as technical knowledge in English, skill for team work, and communication.

【Grading】 Presentation, Assignments, and Achievement

【Course Goals】 Acquire the knowledge and skill to design and analyze a microsystem.

【Course Topics】

Theme	Class number of times	Description
Tutorial on microsystem CAD software	3	Master CAD program for microsystem design and analysis which will be utilized to accomplish an assignment.
Lecture and Task Introduction	2	Learn basic knowledge necessary to design a microsystem/MEMS(Micro Electromechanical Systems) utilizing microfabrication technology.
Design and analysis work	3	Analyze and design a microsystem by communicating with a team member of HKUST.
Presentation I	2	The designed device and its analyzed results is presented in detail by team in English.
Evaluation of device	3	Evaluate the fabricated microsystem.
Presentation II	2	The measured results and comparison between the analyzed results of the fabricated microsystem is presented by team in English.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering" provided in 1st term.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student of this class is required to register to the course 10G205 "Microsystem Engineering" provided at Friday 4th so as to be able to take consecutive classes at Friday 4th and 5th. Those who want to take this course have to take training course for CAD in advance. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term.

**Radiation Measurement for Medicine**

医学放射線計測学

【Code】10W620 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Fri 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Hidetsugu Tsuchida, Yoshinori Sakurai,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Fundamentals for Physical Effects of Radiation Interactions	2	
Fundamentals for Chemical Effects of Radiation Interactions	1	
Fundamental Quantities and Units for Radiation	2	
Radiation Measurements in Medical Physics	3	
Radiation Dosimetry Estimation for Dose Distribution	2	
Techniques for Radiation Control and Measurement in Medical Radiation Field	1	
Laws and Ordinances for Radiation Therapy	1	
Check of Study Achievement	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to Advanced Nuclear Engineering**

基礎量子エネルギー工学

【Code】10C072 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Micro Process and Material Engineering**

マイクロプロセス・材料工学

【Code】 10G203 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Kotera,O. Tabata,K. Eriguchi,I. Kanno,T. Tsuchiya,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Semiconductor microfabrication	3	
Thin-film process and evaluation	3	
Silicon micromachining	3	
3D lithography	3	
Soft-micromachining	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Multi physics Numerical Analysis**

マルチフィジクス数値解析力学

【Code】 10G209 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 1st

【Location】 Engineering Science Depts Bldg.-101 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	5	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd  
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice  
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

### 【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

### 【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Microsystem Engineering

マイクロシステム工学

【Code】 10G205 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Fri 4th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 O. Tabata, H. Kotera, T. Tsuchiya, R. Yokokawa,

【Course Description】 Microsystem covers not only technologies related to individual physical or chemical phenomenon in micro scale, but also complex phenomena which are evolved from their interaction. In this course, the physics and chemistry in micro and nanoscale will be lectured in contrast to those in macro scale. The various kinds of application devices (ex. physical (pressure, flow, force) sensors, chemical sensors, biosensors, actuators (piezoelectric, electrostatic, and shape memory) and their system are discussed.

【Grading】 The evaluation will be based on the reports given in each lecture.

【Course Goals】 Understand the theory of sensing and actuating in microsystem. Acquire basic knowledge to handle various kinds of phenomena in microscale.

### 【Course Topics】

Theme	Class number of times	Description
MEMS modeling	2	Multi-physics modeling in microscale. Electro-mechanical coupling analysis.
MEMS simulation	2	System level simulation in MEMS.
Electrostatic microsystem	3	Electrostatic sensors and actuators. Theory and application devices.
Physical sensors	4	Physical sensors as a fundamental application in microsystem. Accelerometer, vibrating gyroscope, pressure sensors.
Micro total analysis system	4	Chemical analysis system and bio-sensing device using microsystem.

【Textbook】 Provided in the lecture.

【Textbook(supplemental)】 Provided in the lecture.

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering".

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student can register only to this class 10G205, but it is required to be able to take consecutive classes at Friday 4th and 5th. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term. The student of this class is strongly recommended to take a course 10V201 "Introduction to the Design and Implementation of Micro-Systems"(10V201), which is a practice for designing microsystem. Those who want to take 10V201 have to take training course for CAD in advance.

**Quantum Science**

量子科学

【Code】 10C074 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】 This course involves fundamental interactions of electrons, ions and photons to atoms, molecules and condensed matters, and practical applications for nanotechnology. Great emphases are on fundamental mechanisms of beam-solid interactions, characterization techniques, material synthesis and processing for quantum devices with quantum beam. Recent progress of related area of quantum beam will be also introduced in this course.

【Grading】 Coursework will be evaluated with attendance and report on subjects.

【Course Goals】 To provide students to understand fundamental interactions in quantum science.

【Course Topics】

Theme	Class number of times	Description
Interactions between quantum beams and solids	7	Interactions between quantum beams and solids are described with various formulas. Collisions with nucleus, electronic excitation, defect formation and energy loss will be discussed and related scientific topics, such as discovery of electron will be introduced.
Applications of quantum beams	7	The interactions of quantum beam are widely used for various applications. Material processing and analysis with quantum beams are essential in nanotechnology and quantum beams are also important for diagnostics of diseases and cancer therapy in medical field. Practical applications will be presented with recent progress and challenges.
Final examination and report	1	Evaluation will be given by the contents of the reports and quizzes of the subjects leaned in this course.

【Textbook】 Ion-Solid Interactions: Fundamentals and Applications (Cambridge Solid State Science Series) M. Nastasi, J. Mayer, J. Hirvonen

【Textbook(supplemental)】

【Prerequisite(s)】 Solid state physics, Quantum mechanics(beginner ' s), Electromagnetism

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Radiation Physics and Engineering**

放射線物理工学

【Code】 10C017 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	5	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Radiation Medical Physics

放射線医学物理学

【Code】 10C047 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Yoshinori Sakurai, Takushi Takata

【Course Description】 Medical physics is the general term for the physics and technology which are supporting radiation diagnosis and therapy, and particle therapy. As it covers many different fields, the important subjects are “ promotion for the advance of radiation therapy ” and “ quality assurance for radiation therapy ” . The scope of this course is to learn the fundamental knowledge for radiation medical physics. Especially, the focus is put on the understanding for (1) the bases of physics, biology and so on for radiation, (2) the physics for the radiations applied to diagnosis, (3) the characteristics of radiations and particle beams applied to therapy, and (4) the radiation protection, quality assurance and so on for radiation diagnosis and therapy.

【Grading】 Attendance and reports

【Course Goals】 To learn the fundamental knowledge of medical physics, mainly for radiation physics in diagnosis and therapy

【Course Topics】

Theme	Class number of times	Description
Fundamental physics for radiation	2	
Fundamental biology for radiation	1	
Radiation measurement and evaluation	3	
Physics in radiation diagnosis	3	
Physics in radiation therapy	3	
Quality assurance and standard dosimetry	1	
Radiation protection Achievement Assessment	1	

【Textbook】 Not specified. Handouts will be given for each topic.

【Textbook(supplemental)】 F.M.Khan, “ The Physics of Radiation Therapy: Mechanisms, Diagnosis, and Management ” (Lippincott Williams & Wilkins, Baltimore, 2003)

【Prerequisite(s)】 It is recommended to attend the course, “ Radiation Measurement for Medicine ” , concurrently.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Radiation Biology and Medicine**

放射線生物医学

【Code】 10C046 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 2nd

【Location】 Bldg.No.1-Nuclear Engineering Sminar Room 1 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Relay Lecture 【Language】 Japanese 【Instructor】 ,,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	5	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Hybrid Advanced Accelerator Engineering**

複合加速器工学

【Code】10C078 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 3rd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Yoshiharu Mori,

【Course Description】Particle accelerator is essential for proceeding nuclear and particle physics but also becomes a very important tool for future nuclear sciences and engineering. In this lecture, a basics theory of accelerator physics including beam optics and dynamics of the circular accelerators is given, and also various applications of the accelerators are also presented.

【Grading】Reports on practical issues and subjects.

【Course Goals】This lecture aims to learn a basic accelerator theory and to attain abilities to make a primitive design of circular accelerator.

## 【Course Topics】

Theme	Class number of times	Description
Hisitory and outline of particle accelerator	1	
Basic theory of beam dynamics in circular accelerator	2	
Beam oribit theory	3	
Hardwares of particle accelerator	2	
Strong focusing theory and lattice design	3	
Radio frequency acceleration theory	3	
Summary and check the accomplishment	1	

## 【Textbook】

【Textbook(supplemental)】J.J.Livingood, Cyclic Particle Accelerator, Van Nostland, New York (1961).E.D. Courant and H.S.Snyder, Ann. Physics, 3,1(1958).

## 【Prerequisite(s)】

## 【Independent Study Outside of Class】

## 【Web Sites】

## 【Additional Information】

**Diagnostic Imaging**

画像診断学

【Code】10W606 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Radiation Treatment Planning,Radiation Treatment Metrology,Practice**

放射線治療計画・計測学実習

【Code】10W618 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day &amp; Period】

【Location】 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Nuclear Engineering Application Experiments**

原子力工学応用実験

【Code】 10C068 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Nuclear Engineering, Adv.**

原子核工学最前線

【Code】10C084 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Thu 4th

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	11	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Polymer Physical Properties**

高分子物性

【Code】10D651 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Thu 2nd

【Location】A2-307 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirokazu Hasegawa, Takenao Yoshizaki, Tsuyoshi Koga, Mikihiro Takenaka, Hiroyuki Aoki,

【Course Description】A concise explanation is given of physical properties of polymer solutions and polymeric solids along with relevant basic theories.

【Grading】Final grades will be evaluated in a comprehensive manner on the basis of attendance, reports, and examinations.

【Course Goals】Fundamental knowledge of physical properties of polymer materials.

## 【Course Topics】

Theme	Class number of times	Description
Polymer Chain Conformation in Dilute Solutions	3	After a clarification of basic factors which determine the conformations of real polymer chains in dilute solutions, some polymer chain models are introduced to describe the equilibrium conformational behavior of the real chains. Further, behavior of average chain dimensions as a functions of molecular weight is considered based on the chain models.
Thermodynamics and Phase Behavior of Polymer Solutions	3	Various phase transition phenomena in polymer solutions (phase separation, hydration, association, gelation, etc.) are systematically explained from thermodynamic and statistical-mechanical viewpoints. "Phase separation of polymer solutions", "Aqueous polymer solutions", and "Association and gelation of polymers" are discussed in the lectures.
Exercise	1	Exercise in polymer solutions.
Structure and Mechanical Properties of Polymeric Solids	4	Polymeric solids such as rubber and plastics, especially thermodynamics of rubber elasticity, polymer crystallization and crystalline/amorphous higher-order structures, are discussed. Moreover, fundamentals of viscoelastic properties of polymers are introduced to provide the understandings of relaxation phenomena such as glass transition.
Electronic and Optical Properties of Polymeric Solids	3	The electronic and optical properties of polymers is reviewed. The application of polymer materials in the opto-electronics and display devices is also presented.
Exercise	1	Exercise in polymeric solids.

【Textbook】Lecture notes distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】Fundamental knowledge of physical chemistry.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Functional Chemistry**

高分子機能化学

【Code】10H645 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Mon 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Polymerization Reactions**

高分子生成論

【Code】10H607 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Mitsuo Sawamoto and Makoto Ouchi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	3	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



## Polymer Structure and Function

高分子機能学

【Code】 10H613 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 S. Ito, H. Ohkita, H. Aoki,

【Course Description】 Polymers are indispensable in our modern society, fundamental in industry, and functional for chemistry, medicine, electronics, and many other advanced and emerging technologies. In this class, photo- and electric functions of polymeric materials are discussed on the basis of photochemistry and photophysics. In particular, the importance of designing nanostructures of polymer assembly is highlighted by explaining examples of state-of-the-art real systems.

【Grading】 Evaluated with the grade on the final test or the quality of report submitted after the final class.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Conductive Polymers	2	
Photofunctional Polymers	3	
Nanostructure and Dynamics of Polymers	2	
Optoelectronic Polymers	3	

【Textbook】 None: Some handouts will be dealt in the class of every lecture.

【Textbook(supplemental)】 None:

【Prerequisite(s)】 Students are expected to have knowledge of Physical Chemistry and Polymer Chemistry provided in chemistry course of undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This lecture is held every other year, not offered in 2015.

## Polymer Supermolecular Structure

高分子集合体構造

【Code】10H616 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirokazu Hasegawa, Mikihiro Takenaka,

【Course Description】 Polymers self-assemble or self-organize by intra- and/or intermolecular interaction to form assembled structures of polymer molecules. Such structures are closely related to the properties of the polymeric materials, it is necessary to control the assembled structures of the constituent polymer molecules in order to control the properties of polymeric materials, especially solid materials. In this lecture particularly, formation mechanisms, analytical techniques, and elucidated structures of crystalline polymers, phase-separated structures of polymer mixtures, microphase-separated structures of block and graft copolymers will be discussed.

【Grading】 The grading is based on the short tests and report assignments.

【Course Goals】 This course aims for the development of the faculty to infer the properties of polymeric materials from their morphology based on the knowledge of structure-property relationships of higher-order structures of crystalline polymers, phase-separated structures of polymer mixtures (blends), microdomain structures of block copolymers, etc.

【Course Topics】

Theme	Class number of times	Description
Self-assembly and Self-organization	1	The differences between self-assembly and self-organization will be discussed by referring the examples in natural phenomena and polymeric systems.
Crystalline Polymers	3	In the lectures, unit cell structures and hierarchical higher-order structures of polymer crystals such as folded-chain lamellar crystals and spherulites, as well as deformation and thermal behavior of polymer crystals will be discussed.
Polymer Blends	5	Miscibility, phase-diagrams, mechanisms and dynamics of phase transitions, relationships between phase-separated structures and properties, methods to control the phase-separated structures will be discussed.
Block and Graft Copolymers	5	The lectures include nano-scale domain formation of block copolymers by microphase-separation, miscibility and phase diagrams, order-disorder and order-order transitions, bicontinuous structures, structure formation in thin films, blends with homopolymers or other block copolymers, multi-component multi-block copolymers, miktoarm star block copolymers, and more.
Evaluation of Degree of Understandings	1	Degree of understandings of the lectures will be evaluated by means of a short test and group discussions.

【Textbook】 Not used.

【Textbook(supplemental)】 Introduced in the lectures.

【Prerequisite(s)】 Thermodynamics preferable.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomacromolecular Science**

生体機能高分子

【Code】10H611 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】A1-001 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Solution Science**

高分子溶液学

【Code】10H643 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd  
 【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】Takenao Yoshizaki, Yo Nakamura,

【Course Description】Effects of stiffness and local conformations of polymer chains on polymer solution properties observed in the light scattering and viscosity experiments are considered based on appropriate polymer chain models.

【Grading】Term-end examination.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Review	1	Definitions of physical quantities determined from the light scattering and viscosity measurements and the theoretical formulations of those quantities.
Experiments in dilute polymer solutions	2	Principles of the light scattering and viscosity experiments.
Polymer chain models and their statistics	2	Static models for polymer chains: the Gaussian chain, the wormlike chain, and the helical wormlike chain. A comparison of experimental data for the mean-square radius of gyration with relevant theories.
Excluded-volume effects	2	Intra- and intermolecular excluded-volume effects represented by the expansion factors and the second virial coefficient, respectively.
Steady-state transport properties	2	A comparison of experimental data for the intrinsic viscosity and diffusion coefficient with relevant theories.
Dynamic properties	2	Dynamic models for polymer chains: the Rouse-Zimm spring-bead model and the dynamic helical wormlike chain. A comparison of experimental data for the first cumulant of the dynamic structure factor with relevant theories.

【Textbook】Lecture note distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge of polymer solutions given in the lecture "Polymer Physical Properties (10 D651)."

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physical Chemistry of Polymers**

高分子基礎物理化学

【Code】10H622 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 2nd  
 【Location】A2-307 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】lecture 【Language】Japanese  
 【Instructor】Tsuyoshi Koga

【Course Description】Molecular mechanism of characteristic physical properties of polymeric systems is lectured on the basis of the equilibrium and non-equilibrium statistical mechanics. Main topics are phase separation of polymer solutions and mixtures, microphase separation of block copolymers, gelation, rubber elasticity, and rheology of physical gels.

**【Grading】**

【Course Goals】Understanding the molecular mechanism of characteristic physical properties of polymeric systems based on the equilibrium and non-equilibrium statistical mechanics.

**【Course Topics】**

Theme	Class number of times	Description
phase separation of polymer solutions and mixtures	2	phase diagram, Flory-Huggins theory, mean-field theory, phase separation, spinodal decomposition
microphase separation of block copolymers	1	microphase separation, density functional theory, directed self-assembly
gelation	1	definition of gels, classification of gels, classical theory of gels, sol-gel transition, elastically effective chains
rubber elasticity	3	affine network theory, phantom network theory, tetra-PEG gel, slide-ring gel
rheology of associating polymers	3	telechelic associating polymers, linear viscoelasticity, Maxwell model, shear thickening, transient network theory, colloid/polymer mixture, shear-induced gel
verification of understanding	1	

**【Textbook】**

【Textbook(supplemental)】P.J. Flory, "Principles of Polymer Chemistry" (Cornell Univ. Press, New York, 1955)  
 M. Rubinstein, R.H. Colby, "Polymer Physics" (Oxford Univ. Press, New York, 2003)

**【Prerequisite(s)】****【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

**Polymer Spectroscopy**

高分子分光学

【Code】10H625 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	2	
	2	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Polymer Materials**

高分子材料設計

【Code】 10H628 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】

【Location】 ICR Seminar Room 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Controlled Synthesis**

高分子制御合成

【Code】10H647 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomaterials Science and Engineering**

高分子医工学

【Code】 10H633 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 2nd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	2	
	2	
	1	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Physics and Function**

高分子機能物性

【Code】10H029 【Course Year】Master Course 【Term】(not held; biennially) 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Engineering for Chemical Materials Processing**

化学材料プロセス工学

【Code】 10H021 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 Wed 4th

【Location】 A2-302 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 M.Ohshima,S.Nagamine,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	1	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Fine Particle Technology, Adv.**

微粒子工学特論

【Code】 10H017 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 Mon 2nd

【Location】 A2-303 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Shuji Matsusaka,

【Course Description】 Analyses of particle behavior in gases, Particle handling operations, and measurement methods are lectured. Also, particle charging that affect particle behavior in gases are theoretically explained. Furthermore, the control of the particle charging and its applications are lectured.

【Grading】 Examination

【Course Goals】 Understand the analysis and modeling of dynamic behavior of particles. Furthermore develop the ability to apply the knowledge for particle handling and processing.

【Course Topics】

Theme	Class number of times	Description
Particle properties and measurements	3	Mathematical description of particle diameter distribution, properties of fine particles, and their measurement methods are explained.
Particle adhesion and dynamical analysis	3	Measurement methods for adhesion forces of particles and dynamical analysis method for particle collision and elastic deformation are lectured. Furthermore, distinct element method is explained.
Behavior of particles in airflow	3	Temporal and spatial distribution of deposition and reentrainment of fine particles in gas-solid flow are explained using physical models and probability theory. In addition, complicated reentrainment phenomena during particle collision are discussed.
Particle charging and control	2	Concept of particle charging and quantitative analysis methods of charging process are explained; also, charge distribution of particles is analyzed. Furthermore, new methods to control particle charge are introduced.

【Textbook】 Lecture notes

【Textbook(supplemental)】 K. Okuyama, H. Masuda and S. Morooka: Biryuushi Kougaku – Fine particle technology, Ohmsha, Tokyo (1992)

【Prerequisite(s)】 Basic knowledge on powder technology in bachelor course

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Surface Control Engineering**

界面制御工学

【Code】 10H020 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 Wed 2nd

【Location】 A2-305 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 M.Miyahara,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Thermodynamics for Materials Science, Adv.**

材料熱力学特論

【Code】 10C208 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	2	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemistry of Polymer Materials**

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day &amp; Period】Fri 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemistry of Biomaterials**

生体材料化学

【Code】10H031 【Course Year】Master Course 【Term】 【Class day &amp; Period】Tue 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	12	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Functionalized Nucleic Acids Chemistry**

機能性核酸化学

**【Code】**10H426 **【Course Year】**Master and Doctor Course **【Term】** **【Class day & Period】** **【Location】** **【Credits】****【Restriction】**No Restriction **【Lecture Form(s)】**Lecture **【Language】**Japanese **【Instructor】**Nishimoto and Tanabe,**【Course Description】** A number of challenges have been made on development of modified DNA, RNA and proteins, chemical or physical properties of which are controlled by several triggers. These intelligent materials are promising for next generation gene diagnostics and therapy. In this lecture, we discuss the molecular design of these artificial biological materials and their application.**【Grading】** attendance and report (or term-end examination)**【Course Goals】** Synthetic chemistry of DNA, RNA and protein//Chemical structure and basic function of biological materials//Regulation of biological function//Medical applications of artificial DNA, RNA and protein**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Chemical structure and synthesis	2	Synthetic chemistry of nucleic acids
Gene manipulation	2	Synthesis of protein Gene Sequencing
Functions of intelligent molecules	2	Function of artificial peptides Functions of artificial nucleic acids
Drugs related to DNA	2	DNA cleavage by drugs Crosslinking by artificial nucleic acids Alkylation by drugs
Expansion of genetic code	2	Artificial nucleobases Synthesis of modified protein in cells
Medical application	2	Molecular targeting Molecular imaging
Recent topics	3	

**【Textbook】****【Textbook(supplemental)】** No textbooks are used.**【Prerequisite(s)】** Basic knowledge in organic chemistry and biological chemistry is requisite.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

**Molecular Biology**

分子生物化学

【Code】10H812 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 2nd  
 【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】,,

【Course Description】Biological responses are elicited at the interface of intrinsic genetic information and extrinsic environmental factors. This course discusses on molecular aspects of brain function and immunity. Experimental tools such as fluorescent probes for second messenger molecules are also explained through performance of experiments using the probes.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basics	1	
Principles of neurotransmission	3	
Immunity and inflammation	2	
Gaseous bioactive molecules	2	
Experiments to observe cellular responses	3	

【Textbook】Provided in the course

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biorecognics**

生体認識化学

【Code】10H815 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Thu 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Bioorganic Chemistry**

生物有機化学

【Code】10H813 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	1	
	1	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Microbiology and Biotechnology**

生物学

【Code】10H816 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd  
 【Location】A2-308 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Haruyuki Atomi, Tamotsu Kanai

【Course Description】 This lecture will introduce the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. Commonly used tools in the fields of biochemistry, molecular biology and genetics will also be discussed. In addition, methods to utilize cells and their enzymes in biotechnology will be introduced. Lectures will be given in English, with the aim to improve communication/discussion skills.

【Grading】 Grading will be based on presentations (60%) and attendance (40%).

【Course Goals】 Basic knowledge on the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. An understanding of the commonly used tools in the fields of biochemistry, molecular biology and genetics as well as methods to utilize cells and their enzymes in biotechnology. Lectures will be given in English, with the aim to improve communication/discussion skills.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Introduction	1	Diversity of life, classification of organisms, structure and function of fundamental biomolecules.
Basic mechanisms to sustain life	3	Strategies to conserve energy, biosynthesis, cell division, cell differentiation.
Strategies to adapt to environmental conditions	2	Effect of environmental conditions on cells and biomolecules, thermophiles, acidophiles and their enzymes.
Protein engineering	2	Methods to study enzymes and enzyme reactions, methods to enhance their performance.
Cell engineering	2	Methods utilized in metabolic engineering, cell surface engineering, synthetic biology.
Topic discussion	1	Particular topics will be chosen for discussion

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physical Organic Chemistry**

物理有機化学

【Code】10H808 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Thu 2nd

【Location】A2-308 【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kenji Matsuda

【Course Description】Properties of organic compounds, such as electric conductivity, magnetism, photophysical properties, are discussed in terms of molecular structure and electronic structure

【Grading】Report

【Course Goals】To understand principles of photochemistry

【Course Topics】

Theme	Class number of times	Description
Photochemical Reaction	1	Photochemistry, Photophysics, einstein (unit), Jablonski diagram, Excitation, Internal conversion, Intersystem crossing, Fluorescence, Phosphorescence, Photochemical reaction
Excited States in Molecular Orbital Theory	2	Born-Oppenheimer approximation, Franck-Condon principle, Singlet, Triplet, Energy gap, n-pi*, pi-pi*, Potential energy surface, Conical intersection, Solvatochromism
Electronic Transition	2	Transition probability, Fermi's golden rule, Transition moment, Oscillator strength, Polarized light, Stimulated emission, Einstein coefficient, Beer-Lambert law, Selection rule, Spin-orbit coupling
Radiative Transition	2	Fluorescence, Phosphorescence, Fluorescence excitation spectrum, Mirror relationship, Vibrational structure, Fluorescence quantum yield, Emission rate constant
Behavior of	2	Energy Transfer, Quenching, Trivial, Foerster, Dexter, FRET, Stern-Volmer plot, Excimer, Exciplex, Triplet sensitization
Photochemical reaction, Photoisomerization	2	Quantum yield, Photochromism, Conversion in photoisomerization

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Organic Chemistry**

先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 1st

【Location】A2-306 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Jun-ichi Yoshida and other professors

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Reactions
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	1	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Organic Chemistry 2 Continued**

先端有機化学統論

【Code】10P818 【Course Year】Master 1st 【Term】1st term 【Class day &amp; Period】Tue 1st

【Location】A2-306 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Biological Chemistry**

先端生物化学

【Code】10H836 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】 【Location】A2-308

【Credits】3 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	3	
	4	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Biological Chemistry 2 Continued**

先端生物化学続論

【Code】 10P836 【Course Year】 Master Course 【Term】 【Class day &amp; Period】 【Location】 【Credits】 1

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomolecular Function Chemistry**

生体分子機能化学

【Code】 10H448 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day &amp; Period】 Mon 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Shirakawa, Sugase

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Frontiers in the Field of Chemical Biology and Biological Chemistry**

化学から生物へ 生物から化学へ

**【Code】** 10H409 **【Course Year】** Master and Doctor Course **【Term】** 2nd term **【Class day & Period】** Tue 5th**【Location】** A2-302 **【Credits】** **【Restriction】** No Restriction **【Lecture Form(s)】** Relay Lecture**【Language】** English **【Instructor】** K. Akiyoshi, M. Shirakawa, Y. Tabata, I. Hamachi, Y. Mori, M. Umeda, H. Atomi,**【Course Description】** In the cutting-edge of research fields, chemistry and biology are being closely related each other. In this class, progress in such interdisciplinary areas and topics including natural products, biophysics, bioimaging, biomaterials, regenerative medicine, microbiology, thermal biology, structural biology, chemical biology, molecular physiology and others, are briefly explained and discussed.**【Grading】** Evaluation will be conducted by attendance and scores for exercises and problems that each lecturer charges in his topics**【Course Goals】** Students will be able to understand recent progress and trends in broad interdisciplinary areas between biology and chemistry and make their own ideas in these research fields from a viewpoint of individual researchers and engineers.**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
10/6-1/12	11	The guidance will be conducted at the first day of this class (Oct. 6th, 2015).

**【Textbook】****【Textbook(supplemental)】****【Prerequisite(s)】** Fundamentals in chemistry, biochemistry, biology, and materials science.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】** The credit for MS2 students will be guided in detail at the first day.

**Physiology**

生理学

【Code】10H641 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Beam Science, Adv.**

量子ビーム科学特論

【Code】 10R001 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	4	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Neutron Science**

中性子科学

【Code】10C018 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 1st

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	6	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Manipulation Technology**

量子制御工学

【Code】10C031 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 1st

【Location】Bldg.No.1-Nuclear Engineering 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	14	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Applied Neutron Engineering**

応用中性子工学

【Code】 10C082 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	4	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Physics**

医学物理学

【Code】10W652 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Human Anatomy**

人体構造学

【Code】 10W696 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 3rd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Polymer Industry**

高分子産業特論

【Code】10H638 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Fri 3rd and 4th

【Location】A2-306 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physics of Mesoscopic Materials**

メゾ材料物性学

【Code】 10C234 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Akira Sakai, Shu Kurokawa,

【Course Description】 The first half of the lecture explains the mesoscopic phenomena, a variety of electronic transport phenomena observed in a nano- or atomic-scale specimen that is smaller in size than the mean free path of electrons. The second half covers scanning probe microscopy (SPM), a powerful observation tool widely exploited in nanotechnology. Principles of various types of SPM and their applications in materials science are exposted with many illustrative examples.

【Grading】 Grading will be made based on the report on the assigned problems.

【Course Goals】 The final goal of this lecture is to make students acquire basic understanding on the mesoscopic phenomena and the characterization of materials with SPM.

**【Course Topics】**

Theme	Class number of times	Description
Mesoscopic electron transport phenomena	7	1. Introduction to electronic conduction 2. Low-dimensional electron systems 3. Quantum interference of conduction 4. Quantum interference phenomena in electronic conduction 5. Ballistic electron transport 6. Single-electron tunneling 7. Quantum Hall effect and some new topics in mesoscopic physics
Materials characterization with SPM	8	1. Atomic and electronic structures of surfaces 2. Properties of tunneling electrons 4. Forces acting across ultrasmall junctions 5. Materials characterization with SPM (1) 6. Materials characterization with SPM (2) 7. Materials characterization with SPM (3) 8. Cutting-edge SPM researches

【Textbook】 Lecture notes in a paper form will be distributed.

【Textbook(supplemental)】

【Prerequisite(s)】 Prerequisite courses: "Solid state physics", or equivalent, in the undergraduate course.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomechanics**

バイオメカニクス

【Code】 10V003 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	Class number of times	<b>Description</b>
Introduction	1	
	2	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomolecular Dynamics**

生体分子動力学

【Code】 10D450 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	3	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Robotics**

ロボティクス

【Code】 10B407 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Fumitoshi Matsuno,

【Course Description】 Understanding of intelligent behaviors of living things is very interesting. And realization of their intelligent motion by a robot is also attractive for mechanical engineering. In this lecture, we consider basic understanding of beautiful human skill “ manipulation ” on the point of view of dynamics and control. First modeling methodologies for a rigid multibody system and a general dynamic model of a manipulator are provided. Next, a typical nonlinear control law is introduced and some problems for applying the controller are shown. Based on nature of the dynamics of the manipulator, a very simple and robust controller can be derived by designing energy of the system. This lecture provides modeling methodologies and controller design strategies of the rigid multibody system and we analyze a beautiful human skill of the manipulation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	3	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Materials**

分子機能材料

【Code】 10H413 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day &amp; Period】 Wed 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 A. Ito

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】





## Special Topics in Transport Phenomena

移動現象特論

【Code】 10H002 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day & Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlter, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Topics in Transport Phenomena ( English lecture )**

Advanced Topics in Transport Phenomena

**【Code】** 10H003 **【Course Year】** Master and Doctor Course **【Term】** Spring term**【Class day & Period】** Tue 4th **【Location】** A2-305 **【Credits】** 1.5 **【Restriction】** No Restriction**【Lecture Form(s)】** Lecture **【Language】** English **【Instructor】** Ryoichi Yamamoto

**【Course Description】** After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ”, “ Hydrodynamic Interaction ”, and “ Linear Response Theory ” will also be given.

**【Grading】** Answers to several questions and exercises, which will be given during the course, are used to judge.

**【Course Goals】** To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

**【Textbook】** Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

**【Textbook(supplemental)】** Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlder, (Cambridge)

**【Prerequisite(s)】** Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

**【Independent Study Outside of Class】**

**【Web Sites】**

**【Additional Information】**

**Chemical Reaction Engineering, Adv.**

反応工学特論

【Code】 10H008 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Kawase, (EPRC) Nakagawa,

【Course Description】 The following contents are covered:

- Kinetic analysis of gas-solid-catalyst reaction, gas-solid reaction, CVD reaction, and enzymatic reaction,
- Operation and design of reactors for gas-solid-catalyst and gas-solid reactions, and
- Industrial reactors including fixed bed, fluidized bed, moving bed, simulated moving bed, and stirred tank types.

【Grading】 Based on the result of examination at the end of term and the results of quizzes and reports imposed every week

【Course Goals】 To understand kinetic analysis of chemical reactions utilized in the industry and procedure to design and operate industrial reactors.

【Course Topics】

Theme	Class number of times	Description
Gas-solid-catalyst reaction (1) Overview	1	Commercial catalysts and industrial gas-solid-catalyst reactions are overviewed. Chemical reaction engineering fundamentals of the gas-solid-catalyst reaction is explained.
Gas-solid-catalyst reaction (2) Generalized effectiveness factor and selectivity in complex reactions	1	The generalized effectiveness factor and the selectivity affected by mass transfer are explained.
Gas-solid-catalyst reaction (3) Deactivation and regeneration of catalyst	2	Deactivation mechanisms of solid catalysts are overviewed. The deactivation and consequent change in selectivity are explained in terms of the decay function and specific activity.
Gas-solid-catalyst reaction (4) Design and operation of industrial catalytic reactors	1	Industrial catalytic reactors including fixed-bed and fluidized-bed reactors are overviewed. Design and operation of these reactors including thermal stability are explained.
Liquid-solid-catalyst reaction -- Simulated moving bed reactor	1	Concepts and theories of simulated moving bed is explained. Its application to catalytic reactions are reviewed.
CVD reaction (1) Fundamentals	1	Thermal and plasma chemical vapor deposition reactions and processes are overviewed. Fundamentals from chemical reaction engineering view point are explained.
CVD reaction (2) Kinetic analysis and modeling	1	Kinetic analysis of CVD is described from CRE viewpoint. Reaction models including elementary reaction model and overall reaction model are derived and applied to some examples.
Gas-solid reaction (1) Kinetic analysis	2	Kinetic measurement and analysis of complicated gas-solid reactions, particularly coal pyrolysis, are explained with the first-order reaction model to the distributed activation energy model (DAEM).
Gas-solid reaction (2) Kinetic analysis of gas-solid reaction	1	Concepts and derivation of the reaction models including the grain model and the random-pore model are explained. Application of the models to coal gasification is overviewed.

【Textbook】 Prints are distributed.

【Textbook(supplemental)】

【Prerequisite(s)】 Needs knowledge of chemical reaction engineering including heterogeneous reactions.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemical Reaction Engineering, Adv. ( English lecture )**

Chemical Reaction Engineering, Adv.

**【Code】** 10H009 **【Course Year】** Master and Doctor Course **【Term】** **【Class day & Period】** Fri 2nd **【Location】** A2-305**【Credits】** **【Restriction】** **【Lecture Form(s)】** **【Language】** English **【Instructor】** Kawase, (EPRC) Nakagawa**【Course Description】** This lecture is given in English. The following contents are covered: - Kinetic analysis of gas-solid-catalyst reaction, gas-solid reaction, and CVD reaction, - Operation and design of reactors for gas-solid-catalyst and gas-solid reactions, and - Industrial reactors including fixed bed, fluidized bed, moving bed, simulated moving bed, and stirred tank types.**【Grading】** Based on the result of examination at the end of term and the results of quizzes and reports imposed every week.**【Course Goals】** To understand kinetic analysis of chemical reactions utilized in the industry and procedure to design and operate industrial reactors.**【Course Topics】**

<b>Theme</b>	<b>Class number of times</b>	<b>Description</b>
Gas-solid-catalyst reaction (1) Fundamentals	1	Commercial catalysts and industrial gas-solid-catalyst reactions are overviewed. Chemical reaction engineering fundamentals of the gas-solid-catalyst reaction is explained.
Gas-solid-catalyst reaction (2) Generalized effectiveness factor and selectivity in complex reactions	1	The generalized effectiveness factor and the selectivity affected by mass transfer are explained.
Gas-solid-catalyst reaction (3) Deactivation and regeneration of catalyst	2	Deactivation mechanisms of solid catalysts are overviewed. The deactivation and consequent change in selectivity are explained in terms of the decay function and specific activity.
Gas-solid-catalyst reaction (4) Design and operation of industrial catalytic reactors	1	Industrial catalytic reactors including fixed-bed and fluidized-bed reactors are overviewed. Design and operation of these reactors including thermal stability are explained.
Liquid-solid-catalyst reaction -- Simulated moving bed reactor	1	Concept and applications of simulated moving bed reactor are explained. Model-based analysis of simulated moving bed reactor is explained.
CVD reaction	2	Fundamentals of CVD reactions are explained from chemical reaction engineering view point. Kinetic analysis of CVD is described. Reaction models including elementary reaction model and overall reaction model are derived and applied to some examples.
Gas-solid reaction (1) Kinetic analysis	2	Kinetic measurement and analysis of complicated gas-solid reactions, particularly coal pyrolysis, are explained with the first-order reaction model to the distributed activation energy model (DAEM).
Gas-solid reaction (2) Kinetic analysis of gas-solid reaction	1	Concepts and derivation of the reaction models including the grain model and the random-pore model are explained. Application of the models to coal gasification is overviewed.

**【Textbook】** Prints are hand out at the class.**【Textbook(supplemental)】****【Prerequisite(s)】** Needs knowledge of chemical reaction engineering including heterogeneous reactions.**【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

**Separation Process Engineering, Adv.**

分離操作特論

【Code】 10H005 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 Mon 2nd

【Location】 A2-305 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 H.Tamon, N.Sano,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
	1	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Introduction to Advanced Material Science and Technology ( English lecture )

## 先端マテリアルサイエンス通論 ( 英語科目 )

【Code】10K001 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Fri 4th 【Location】KatsuraA2-308,Yoshida Research Bldg.No4,-Room3(Distance lectures)

【Credits】First term: 2, Spring term: 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】GL Edu. Center, J. Assoc. Prof., Tadao Mizuno  
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called "high technologies", and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 先端マテリアル講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Stress-Diffusion Coupling in Polymer Gels	1	Because a polymer gel in solvent forms a thermodynamic semi-open system, a mechanical stimulus imposed on the gel induces a thermodynamic response. The outline of this phenomenon is explained by using several examples. (4/10 T. Takigawa)
Modern Organic Synthesis for Material Science	1	The lecture will deliver recent developments in organic synthesis, particularly focusing on catalytic reactions that have revolutionized chemical processes, and their applications in the production of some important pharmaceuticals and organic materials. (4/17 Y. Nakao)
Oxide Magnetic Materials	1	Fundamentals of magnetism and magnetic properties of oxides as well as applications of magnetic oxide materials are described. A brief introduction to recent magnetics-related technologies such as spintronics is also given. (4/24 K. Tanaka)
In Vivo Optical and Photoacoustic Tumor Imaging using Near-infrared Dye-conjugated Amphiphilic Polymers	1	Optical and photoacoustic imaging methods are one of the most powerful and noninvasive techniques with which to visualize organs as well as tumor tissues. In this lecture, students can learn the basic principles of molecular imaging as well as recent progress in this field. (5/8 K. Ohe)
Photofunctional Nanocarbon Materials	1	Photo-functionalization of nanocarbon materials, e.g., fullerenes, carbon nanotubes, and graphenes, using the methodologies of organic synthetic chemistry and their application in photoelectrochemical devices. (5/15 T. Umeyama)
Rheology Control by Associating Polymers	1	Hydrophobically modified water-soluble polymers (associating polymers) have been used as rheology modifiers or thickeners because rheological properties of solutions and dispersions are drastically changed by the addition of small amounts of associating polymers. In this lecture, recent development on the molecular origin of the structure formation and rheological properties of associating polymers will be reviewed. (5/22 T. Koga)
Solar Hydrogen Production using Semiconductor Photocatalyst	1	The development of a clean and renewable energy carrier that does not utilize fossil fuels is a great technological challenge. Photocatalytic water splitting using semiconductor materials has attracted considerable interest due to its potential to cleanly produce H <sub>2</sub> from water by utilizing abundant solar light. In the present lecture, the basis and the recent progress in photocatalytic water splitting will be introduced. (5/29 R. Abe)
Hyperthermophiles and their thermostable biomolecules	1	This lecture will first introduce the diversity and classification of life. It will then focus on hyperthermophiles and their thermostable molecules, such as proteins, nucleic acids and lipids. (6/5 H. Atomi)
Physical Organic Chemistry of Supramolecular Photofunctional Organic Materials	1	This lecture explains interesting behaviors of photofunctional organic materials, such as photochromic compounds and fluorescence dyes, in the aggregated and self-organized state from the viewpoint of physical organic chemistry. (6/12 K. Matsuda)
Production of Advanced Materials by Micro Chemical Plants	1	This lecture will concentrate on the following topics related to the micro chemical processes. 1) Feature of micro devices, 2) Possibility of using micro systems for real production, 3) Design problems of micro chemical plants, 4) Control of micro chemical plants, 5) Blockage detection of parallelized micro plants, 6) Future direction of the research on micro chemical plants. (6/19 S. Hasebe)
Directed Self-Assembly (DSA) of Block Copolymers	1	Recently, Directed Self-Assembly (DSA) technology of block copolymers has received a lot of attention in the field of semiconductor research. In this lecture, the fundamentals of microphase separation of block copolymers and the application of DSA to lithographic technologies will be reviewed. (6/26 T. Koga)
High-temperature superconductor as a playground for the macroscopic quantum phenomena	1	High temperature superconductors have attracted much attention to their emerging mechanism and applications. They are also quite peculiar for playgrounds for superconducting properties as macroscopic quantum phenomena. In this lecture, quantum phenomena found in high temperature superconductors and their applications are discussed. (7/3 I. Kakeya)
Introduction to Nuclear Materials	1	Nuclear materials are designed for good performance in irradiation field of neutron and high-energy particles. Fundamentals and some examples of nuclear reactions with these particles will be talked. (7/10 I. Takagi)
Materials Processing using external fields for microstructure control	1	Properties of materials are not simply determined by atomic structure and chemical composition. Microstructure (crystal grain size, crystallographic orientation and so on) significantly influences the properties. Not a few techniques have been developed for controlling the microstructure. Materials processing using external fields will be demonstrated in this class. (7/17 H. Yasuda)
Electrodeposition and Electroless Deposition for Materials Processing	1	(1) Fundamentals chemistry, electrochemistry, and thermodynamics, and (2) applications of electrodeposition and electroless deposition for materials processing. (7/24 K. Murase)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Check the notice on the bulletin board.

Students who take Spring term (Lecture code 10H012) should attend first 11 lectures.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.



## Exercise in Practical Scientific English

実践的科学英語演習

【Code】10i045 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】Thu 4th or 5th 【Location】A2-304 【Credits】1

【Restriction】Up to twenty students for each class 【Lecture Form(s)】Seminar 【Language】Japanese and English

【Instructor】Y. Nakayama and M. Nishi

【Course Description】Students learn about the basics of technical writing in English, and learn about and practice the format, style, and mechanics of the scientific research article. Students will also develop skills needed to create and deliver an effective presentation in English. We may restrict the class size to enhance learning. The course is shared by Master ' s and Doctoral Course students.

【Grading】Students are required to submit an initial report and a mid-term report, and make a final presentation in English. Students failing to submit the mid-term report or to make a presentation will be given no credit.

【Course Goals】Students develop basic communication skills needed to work for international organizations through practicing scientific English writing as well as presenting their research in English.

【Course Topics】

Theme	Class number of times	Description
Course Outline and Introduction to Technical Writing	1	Students examine the aim and requirements of the course, and look at the key points for writing correctly, clearly, and concisely. (The class schedule may change without notice.)
Basics of Technical Writing	2	Students learn about the definition and basic rules for technical writing, and look at common mistakes made by non-native writers of English.
Japanese-to-English Translation Practice	2	Students learn about English grammar and practice revising their English writing.
Paragraphs	2	Students learn about paragraphs: the topic sentence and supporting sentences, and techniques for sequencing information in a paragraph.
Format of Research Articles	2	Students learn about the standard format of a research article: the title and abstract
Listening Practice	1	Students practice listening comprehension using videos presenting scientific and technical information.
Presentation Practice	3	Students learn and practice techniques for delivering an effective presentation, and experience asking and answering questions.
Online Learning	2	Writing Paragraphs

【Textbook】No text – all materials are supplied by the teachers.

【Textbook(supplemental)】Yukiko Nakayama, Gijutsu kei Eibun Raithingu Kyohon (Technical Writing Textbook), Japan Society for Technical Communication

Anne M. Coghil and Lorrin R. Garson, The ACS style guide, 3rd, The American Chemical Society

【Prerequisite(s)】Students need to have basic English skills at undergraduate level.

【Independent Study Outside of Class】

【Web Sites】<http://www.glc.t.kyoto-u.ac.jp/ja/study/grad/10d040>

【Additional Information】We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance.

**Instrumental Analysis, Adv.**

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Instrumental Analysis, Adv.**

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Experiments and Exercises on Bio-Medical Engineering, Adv. I**

生命・医工分野特別実験および演習第一

【Code】 10W681 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Experiments and Exercises on Bio-Medical Engineering, Adv. II**

生命・医工分野特別実験および演習第二

【Code】 10W683 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering A(MC)**

生命医工分野セミナー A (修士)

【Code】 10W670 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering B(MC)**

生命医工分野セミナー B (修士)

【Code】 10W671 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering A**

生命・医工分野特別セミナー A

【Code】10W685 【Course Year】Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering B**

生命・医工分野特別セミナー B

【Code】 10W687 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering C**

生命・医工分野特別セミナー C

【Code】 10W689 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Seminar on Bio-Medical Engineering D**

生命・医工分野特別セミナー D

【Code】 10W690 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Bio-Medical Engineering Internship M**

インターンシップ M (生命・医工)

【Code】 10W691 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Bio-Medical Engineering Internship D**

インターンシップ D (生命・医工)

【Code】 10W692 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Professional Scientific Presentation Exercises ( English lecture )**

科学技術者のためのプレゼンテーション演習 ( 英語科目 )

【Code】 10i041 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1

【Restriction】 The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】 Reports, class activity, presentation

【Course Goals】 This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 13th, and the 1st lesson is repeated on April 20th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

**Advanced Engineering and Economy ( English lecture )**

工学と経済 ( 上級 )( 英語科目 )

【Code】10i042 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 5th 【Location】B-Cluster 2F Seminar Room

【Credits】2 【Restriction】The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】Lectures, Group works&amp;tasks 【Language】English

【Instructor】Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】Engineering economics plays central role in any industrial engineering project. For an engineer, it is important to apply the engineering know-how with the economic analysis skills to obtain the best available materials, methods, devices, etc. in the most economical way. This course is aimed to teach engineering students the basic economic methods to manage economically an engineering project. In addition, the report writing on various engineering economic issues prepares to write reports in a professional form. The lab sessions are meant for the verbal skills improvement as well as improvement of analytical thinking. The topics are of current relevant topics Small-group brain-storming method is used. The exercise sessions cover the use of Ms-Excel for various quantitative economic analyses.

【Grading】Final test, reports, class activity

【Course Goals】This course is aimed to strengthen engineering students' skills in economics. The course concept is to teach students selectively those subjects which serve as major tools to solve economic tasks in engineering environment. The reports and lab sessions provide students stimulating and analytical thinking requiring tasks, and presentation skills training is an important part of this course.

【Course Topics】

Theme	Class number of times	Description
Student orientation and Introduction to engineering economy	1	
Cost concepts and design economics	1	
Cost estimation techniques	1	
The time value of money	1	
Evaluating a single project	1	
Comparison and selection among alternatives	1	
Depreciation and income taxes	1	
Price changes and exchange rates	1	
Replacement analysis	1	
Evaluating projects with the benefit-cost ratio method	1	
Breakeven and sensitivity analysis	1	
Probabilistic risk analysis	1	
The capital budgeting process	1	
Decision making considering multiattributes	1	
Final test	1	

Additionally, students will submit five reports during the course on given engineering economy subjects. Also, required are the five lab participations (ca.60 min/each) for each student. Additionally, three exercise sessions (ca.60 min/each), where use of Ms-Excel will be practiced for solving various engineering economy tasks, should be completed

【Textbook】Engineering Economy 15th ed. William G. Sullivan (2011)

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】-This course is highly recommended for those who attend " Engineering Project Management" course , Small group working method

【Independent Study Outside of Class】

【Web Sites】The web-site is listed in the home page of the GL education center.

【Additional Information】Students are requested to check in advance whether the credits of this course are counted as the units for graduation requirement at department level. The course starts on Apr.12th.

**Engineering Project Management (English lecture)**

エンジニアリングプロジェクトマネジメント (英語科目)

【Code】 10i047 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 5th 【Location】 B-Cluster 2F Seminar Room

【Credits】 1 【Restriction】 【Lecture Form(s)】 Lectures, Group works&amp;tasks 【Language】 English

【Instructor】 Lintuluoto, Oishi, Takatori, Nishi, Mizuno, Tanaka

【Course Description】 The purpose of this course is to teach the basic skills needed for expressing and initiating ideas, and presenting information in successful international engineering group work. The course provides simulations for students in group managing and decision making in international engineering teams. International teamwork ethics subjects for successful engineering project will be practiced. The course consists of lectures, case studies, the invited lecture from an industry representative and the final examination. Also, a project report exercise is included in this course.

The course is basically designed for doctor course (DC) students, both Japanese and foreign nationals. If place are available they may be given to master course students.

【Grading】 Report, class activity, presentation

【Course Goals】 This course is the pre-course for Engineering Project Management II which will be held in the second semester. Students will learn project management tools, apply project strategies and perform qualitative risk analyses. Also students will learn how to carry out projects with group members from various countries and engineering fields.

【Course Topics】

Theme	Class number of times	Description
Introduction to the course	1	4/11 The introduction to the course and preliminary knowledge about the engineering project management will be given. (All)
Strategy Viewpoints in Engineering Projects	1	4/18 (Oishi)
Project Management	1	4/25 I (Lintuluoto)
Management of abroad dispatched project	1	5/8 Through an abroad dispatched project of Graduate School of Engineering, Kyoto University, the development and management of the project in University will be given. (Mizuno)
Project management	1	5/15 II (Lintuluoto)
Design thinking	1	5/22 (Takatori)
Public governance of engineering project	1	5/29 The lecturer will be invited from the Ministry of land, Infrastructure, Transport and Tourism. Mr. Wako will talk about Public governance of engineering project (Mizuno)
Risk Identification and Assessment for Engineers	1	6/5 (Nishi)
Risk Identification and Assessment for Engineers	1	6/12 (Nishi)
Engineering project presentation	1	6/19 (Takatori)
Leadership skills	1	6/26 I (Tanaka)
Leadership skills	1	7/3 II (Tanaka)
Special Lecture from Industry	1	7/10 The lecturer will be invited from JGC Corporation (日揮株式会社). Mr. Kumagai will talk about the characteristics of the management of the project for different phases through a project in a foreign country. (Mizuno)
Special Lecture from Industry	1	7/17 The lecturer will be invited from a company. (Mizuno)
Review of the course	1	7/24 Review of the course

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】 ‘ -This course is recommended for those who later intend to attend “ Engineering Project Management II ” .

-Highly interactive lessons (discussion), Small group work methodologies.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department. The course starts on Apr. 10th.

**Engineering Project Management (English lecture)**

エンジニアリングプロジェクトマネジメント (英語科目)

【Code】 10i048 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1 【Restriction】 Student number will be limited.

【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】 Lintuluoto, Mizuno, Oishi, Takatori, Nishi,

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, group leadership, and international communication which they learned in the course of "Engineering Project Management I" to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work and a few intermediate discussions. The course will be held 6 weeks for group work, and two (2) intermediate discussions, project presentation to a wide audience, and a written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

## 【Course Topics】

Theme	Class number of times	Description
Guidance	1	
Group work I	3	
Group work II		
Intermediate discussion I	1	
Group work III	4	
Group work IV		
Intermediate discussion II	1	
Group work V	4	
Group work VI		
Project presentation and discussion	1	

Each project team may freely schedule the group work within the given time frame. In addition to "Intermediate discussion" sessions, the course instructors are available if any such need arises.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Complete the course "Engineering Project Management I" in the 1st term.

-Attendance on "Advanced Engineering Economics" course in the 1st term is strongly recommended.

-Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

**Prospects of Interdisciplinary Photonics and Electronics**

融合光・電子科学の展望

【Code】 10X001 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Fri 2nd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Experiments and Exercises in Interdisciplinary Photonics and Electronics

融合光・電子科学特別実験及演習 1

【Code】 10X003 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Experiments and Exercises in Interdisciplinary Photonics and Electronics

融合光・電子科学特別実験及演習 2

【Code】 10X005 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar on Interdisciplinary Photonics and Electronics**

融合光・電子科学特別セミナー

【Code】 10X007 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Mechanics for Electronics Engineering**

量子論電子工学

【Code】10C825 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	1	
	1	
	1	
	1	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Semiconductor Nanospintronics**

半導体ナノスピントロニクス

【Code】10C800 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 2nd

【Location】A1-131 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	5	
	5-6	
	2-3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Charged Particle Beam Apparatus

電子装置特論

【Code】10C801 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Wed 4th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Yasuhito Gotoh

【Course Description】Fundamental technologies of an ion beam system, such as ion sources, formation and evaluation of ion beams, transport of ion beams, and ion-solid interaction will be presented. Taking ion implantation as one of the example of the ion beam application, the relationship between the incident ion energy and implantation depth will be presented. Each element of a typical ion beam system is explained in detail.

【Grading】Evaluation will be made with the results of final examination. Achievements of exercises in the class are also taken into consideration.

【Course Goals】To understand the details of an ion beam apparatus: generation, transport and evaluation of an ion beam. Understanding of the entire ion beam apparatus as a system is also purpose of the class.

【Course Topics】

Theme	Class number of times	Description
Ion beam systems and their applications	1	Outline of the class is presented. Physical properties of ions in vacuum are given, and ion beam apparatuses and their application will be introduced with some typical examples.
Ion-solid interaction	3	Interaction between high energy ion and solid atoms are given. Major topics are: how the ions transfer their energy to the target atoms, i.e., how the ions are decelerated in the solid, and relationship between incident ion energy and implantation depth is given. Concept of sputtering phenomenon is also presented.
Nature of ion beam	2	Concept of the acceleration voltage is introduced to explain the principle of the ion beam systems. Nature of an ion beam is also presented.
Generation and transport of ion beam	3	Methods of ion generation for various elements are explained. Important equations of beam extraction and beam transport are given. Starting with the paraxial ray equation, concept of transfer matrix is given. Finally, some important physical parameters of ion beams are given.
Mass separators and energy analyzers	3	Details of magnetic sector as mass separator are given. Transfer matrix of the mass separator are presented and focusing effect is described. An important parameter of mass resolution is given. Some different kinds of energy analyzers are also introduced. Deflection and detection systems are also introduced.
Fundamentals of vacuum engineering	2	Fundamentals of vacuum engineering is given. Several pumps used for ion beam systems are also introduced.
Design of ion beam systems	1	Design of an ion beam system under a given condition will be presented. In the last class, achievement test will be performed.

【Textbook】Yasuhito Gotoh, Charged Particle Beam Apparatus, 2015 version (to be sold at CO-OP shop in Katsura Campus)

【Textbook(supplemental)】Junzo Ishikawa, Charged Particle Engineering (Corona).

【Prerequisite(s)】Vacuum Electronic Engineering 1, 2 (undergraduate course)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】We will have brief practice in each class. Bring your calculator and A4-size writing papers.

**Quantum Information Science**

量子情報科学

【Code】10C803 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Mon 3rd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Semiconductor Engineering Adv.**

半導体工学特論

【Code】10C810 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Wed 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】 This course explores the fundamentals of physics of semiconductors, which are essential to understand semiconductor materials and devices.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Band theory	3-4	Electronic Band Structures are discussed. Nearly free electron and tight-binding approaches, k dot p theory, pseudopotential method are explained. Band structures of major semiconductors such as Si and GaAs are also discussed.
	3-4	
	3-4	
	3-4	

【Textbook】

【Textbook(supplemental)】 S. M. Sze Physics of Semiconductor Devices (Wiley Interscience)

P.Y.Yu and M. Cardona Fundamentals of Semiconductors (Springer)

【Prerequisite(s)】 Semiconductor engineering, quantum mechanics (undergraduate level)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Electronic Materials Adv.**

電子材料学特論

【Code】10C813 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Thu 2nd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Semiconductors	6-7	
Superconductors	4-5	
Epitaxial growth	3-4	Semiconductor heterostructures are fabricated by using a crystal growth method called "epitaxy". Fundamentals of epitaxial growth are discussed. One of epitaxial growth methods, molecular-beam epitaxy, is discussed in detail.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Electronics**

分子エレクトロニクス

【Code】10C816 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Mon 5th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	4	
	3	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Surface Electronic Properties**

表面電子物性工学

【Code】10C819 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 5th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Hirofumi Yamada,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	4	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Optical Properties and Engineering**

光物性工学

【Code】10C822 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 4th 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2-3 回	
	7-8 回	
	4-5 回	
	1 回	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Optoelectronics Devices**

光量子デバイス工学

【Code】10C828 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 4th 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	5	
	5	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Optics**

量子光学

【Code】10C829 【Course Year】Master 1st 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Quantum Measurement

量子計測工学

【Code】10C830 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Mon 4th  
 【Location】A1-131 (Katsura #2 lecture room) 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture  
 【Language】Japanese 【Instructor】Kazuhiko Sugiyama

【Course Description】As an example of high precision measurements using quantum phenomena, frequency standards, which is realized with the smallest uncertainty in all measurement quantities at present, are discussed. The principle and evaluation of frequency standards are explained.

【Grading】Report(two times, at the first lecture and the after all lectures)

【Course Goals】The goal of this lecture is to understand that precision measurements are realized with combination of the best technologies and is based on physics.

### 【Course Topics】

Theme	Class number of times	Description
Introduction and principle of time measurement	1	Two principles of time measurement: Reproducibility postulate and dynamic model
Fundamentals of atomic frequency standards	2.5	Atomic states, its energy shifts, high-resolution spectroscopy and high-sensitive detection
Cesium frequency standard and atom interferometer	2.5	Principle of Ramsey resonance and its interpretation as atom interferometer
Specification of frequency standards: evaluation methods and theoretical limit	2	Fundamentals of evaluation of frequency stability with Allan variance, and theoretical limit of frequency stability
Noise	2	Incoherent signals and shot noise
Relativistic theory and time	3	Impact of special and general relativistic theory on time measurement
Others	1	If we have time, the frequency noises of masers and lasers, and other subjects will be lectured.
Evaluation of understanding	1	

### 【Textbook】

【Textbook(supplemental)】C. Audoin and B. Guinot, The Measurement of Time, (Cambridge University Press, 2001). M. Kitano, Fundamentals of electronic circuits (Reimei publishing, 2009) in Japanese.

【Prerequisite(s)】Fundamentals of physics (quantum physics, in particular) and electric circuits including linear system.

The level which average graduate students of electric and electronic science and technology acquire is sufficient.

### 【Independent Study Outside of Class】

【Web Sites】<https://www.kogaku.kyoto-u.ac.jp/lecturenotes/>(Unfortunately, this web page is discontinued from 2014. New pages would appear on PandA system.)

### 【Additional Information】

**Electrical Conduction in Condensed Matter**

電気伝導

【Code】 10C851 【Course Year】 Master 1st 【Term】 1st term 【Class day &amp; Period】 Wed 2nd

【Location】 Electrical Engineering Bldg.-Lecture Room (M) 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	3	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**High Performance Thin Film Engineering**

高機能薄膜工学

【Code】 10C834 【Course Year】 Master 1st 【Term】 1st term 【Class day &amp; Period】 Tue 1st 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2-3	
	2	
	2-3	
	5-6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Integrated Circuits Engineering, Advanced.**

集積回路工学特論

【Code】 693631 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 Electrical Engineering Bldg.-Lecture Room (M) etc. 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Hidetoshi Onodera

【Course Description】 An integrated circuit is a key device that enables functionality enhancement, performance increase, and cost reduction of an electronic system. Steady progress in fabrication technology leads to exponential increase in integration scale. This course focuses on the design methodology of a large-scale integrated circuit (LSI), with particular emphasis on logical and physical design process. Topics covered by the course include the current status and future directions regarding LSI design technology, CMOS process technology, CMOS layout design, CMOS device characteristics, CMOS static gates, CMOS dynamic gates, and LSI design methodology.

【Grading】 The level of achievement will be examined by several reports assigned during lectures.

【Course Goals】 The target of this lecture is to obtain basic knowledge on a design method of integrated circuits such that he/she can complete logic, circuit and layout design for a simple digital circuit.

## 【Course Topics】

Theme	Class number of times	Description
1. Current status and future directions of Integrated Circuit Technology	2	The current status of integrated circuit development will be explained. Brief history and future directions of integrated circuit technology will be covered.
CMOS Process Technology	2	Fabrication process of CMOS will be explained with particular emphasis on photo-masks required for lithography.
MOS Devices	3	Structure and performance characteristics of MOSFET, capacitor and resistor will be explained. Performance degradation of scaled interconnect will be discussed with possible solutions.
CMOS Logic Gates	3	CMOS complementary static gates and dynamic gates will be presented with performance analysis and design methods.
LSI Design Methodology	3	Synchronous design method will be explained. Timing analysis and clocking techniques will be discussed. Low power design methodology will be explained.
FPGA	2	Field programmable gate array and its application will be explained.

【Textbook】 N/A Hand-outs will be provided.

【Textbook(supplemental)】 Neil H.E. Weste and David Harris, " CMOS VLSI Design, 4th Ed. " Addison-Wesley, 2011.

Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, " Digital Integrated Circuits, 2nd Ed. " Prentice Hall, 2003.

【Prerequisite(s)】 Basic knowledge on electronic circuits, digital circuits, logic circuits.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## State Space Theory of Dynamical Systems

状態方程式論

【Code】 10C628 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Wed 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 T. Hagiwara, Y. Ebihara

【Course Description】 The course deals with the dynamical system theory based on linear time-invariant state equations. It covers such topics as state equations, controllability and observability, mode decomposition and its relevance to controllability/observability, stability of dynamical systems, and the Kalman canonical decomposition.

【Grading】 The grading will be based on the exam.

【Course Goals】 To acquire the knowledge on the basic theory for linear system analysis by means of state equations.

【Course Topics】

Theme	Class number of times	Description
feedback systems and state equations	3 ~ 4	fundamentals of state equations, their relationship to transfer functions and block diagram representations
responses of linear systems	5 ~ 6	state transition matrices, equivalence transformation of systems, mode decomposition and Lyapunov stability
controllability and observability	5 ~ 6	controllability and observability, mode decomposition and its relevance to controllability/observability, controllable subspace and unobservable subspace, and the Kalman canonical decomposition; Checking degrees of understanding of all the lecture topics closes the class.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 classical control theory (in terms of transfer functions), linear algebra and calculus

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Handouts will be given at the class.

**Applied Systems Theory**

応用システム理論

【Code】10C604 【Course Year】Master 1st 【Term】2nd term 【Class day &amp; Period】Tue 1st

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】E. Furutani

【Course Description】The course deals with mathematical methods of system optimization mainly for combinatorial optimization problems. It covers such topics as the integer optimization and its typical problems, exact solution methods including the dynamic programming and the branch and bound method, approximate solution methods including the greedy method, meta-heuristics including the genetic algorithms, the simulated annealing method, and the tabu search.

【Grading】The grading will be based on an exam and the evaluation of the reports on the subjects given in the class.

【Course Goals】To acquire the knowledge on formulation of combinatorial optimization problems into integer programming problems, basic concepts, algorithms, characteristics, and application procedures of exact solution methods, approximate solution methods, and meta-heuristics.

## 【Course Topics】

Theme	Class number of times	Description
combinatorial optimization problems and complexity	1-2	necessity and importance of combinatorial optimization, typical problems, complexity, classes P and NP, complexity of combinatorial optimization problems, limitation of exact solution methods, necessity of approximate solution methods and meta-heuristics
exact solution methods	3	principle of optimality, dynamic programming, branch and bound method, and their applications
integer programming	2-3	formulation into integer programming problem, relaxation problem, and cutting plane algorithm
approximate solution methods	1-2	greedy method, relaxation method, partial enumeration method, etc.
meta-heuristics	5-6	local search, basic ideas of meta-heuristics, genetic algorithms, simulated annealing method, tabu search, etc. The level of understanding will be confirmed.

## 【Textbook】

【Textbook(supplemental)】M. Fukushima: Introduction to Mathematical Programming (in Japanese), Asakura, 1996.

Y. Nishikawa, N. Sannomiya, and T. Ibaraki: Optimization (in Japanese), Iwanami, 1982.

M. Yagiura, and T. Ibaraki: Combinatorial Optimization ---With a Central Focus on Meta-heuristics--- (in Japanese), Asakura, 2001.

B. Korte, and J. Vygen: Combinatorial Optimization ---Theory and Algorithms, Third Edition, Springer, 2006.

【Prerequisite(s)】linear programming, nonlinear programming

## 【Independent Study Outside of Class】

## 【Web Sites】

【Additional Information】Handouts and exercises are given at the class.

## Applied Mathematics for Electrical Engineering

電気数学特論

【Code】 10C601 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Thu 1st

【Location】 A1-001 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 T. Hikihara & S. Doi,

【Course Description】 In the class, fundamental mathematics is lectured for electrical engineering, electronics, system engineering, and material science. In particular, system theory, nonlinear dynamics, and particle dynamics in force field can be discussed with mathematical clear image.

【Grading】 Students are requested to reply to report assignments. The grading is based on the evaluation of the reports.

【Course Goals】 Professors expect students to model their system and analyze the models theoretically. Students will be requested to understand their system in principle mechanics and control them based on system theory.

### 【Course Topics】

Theme	Class number of times	Description
	1	
	2-4	
	3-5	
Introduction 2	1	Relationship between the previous classes and further will be explained. The introduction to nonlinear dynamics will be explained based on oscillation theory.
Hamiltonian mechanics	1-3	Hamiltonian mechanics on linear symplectic space is lectured.
Manifold and vector field	2-4	Manifold is discussed in nonlinear system with relation to vector field analysis.

### 【Textbook】

【Textbook(supplemental)】 S. Wiggins, Introduction to Applied Nonlinear Dynamical Systems and Chaos, Springer-Verlag.

【Prerequisite(s)】 Linear algebra

### 【Independent Study Outside of Class】

【Web Sites】 <https://www.t.kyoto-u.ac.jp/lecturenotes/gse/kueeng/10C601/syllabus>

【Additional Information】 Appropriate references will be shown in classes.

**Electrical and Electromagnetic Circuits**

電気電磁回路論

【Code】 10C647 【Course Year】 Master 1st 【Term】 1st term 【Class day &amp; Period】 Wed 2nd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Osami Wada,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	8	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Electromagnetic Theory, Adv.**

電磁気学特論

【Code】 10C610 【Course Year】 Master 1st 【Term】 2nd term 【Class day &amp; Period】 Wed 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 T. Matsuo,

【Course Description】 The first half: computational electromagnetics

The latter half: the special theory of relativity and the covariance of Maxwell's equations

【Grading】 Submission of reports (twice)

【Course Goals】 1. Understanding of computational methods for electromagnetic field analysis

2. Understanding of the basic concepts of special theory of relativity and the covariant formulation of Maxwell's equations

【Course Topics】

Theme	Class number of times	Description
Finite integration method for electromagnetic field analysis	3-4	- Introduction to finite integration method - Application to electromagnetic field analysis
Finite element method for magnetic field analysis	1-2	- Introduction to finite element analysis for magnetic field analysis - Edge element for three-dimensional magnetic field analysis
Electromagnetic field equations in terms of differential forms	2-3	- Differential forms - Maxwell's equations using differential forms
Introduction to special theory of relativity	2-3	- Galilean relativity and special relativity - Lorentz transformation
Tensor representation and relativistic dynamics	2-3	- Introduction to tensor representation - Relativistic dynamics
Covariant formulation of Maxwell ' s equations	2-3	- Electromagnetic field tensor - Lorentz covariance of Maxwell ' s equations

【Textbook】

【Textbook(supplemental)】 Y. Kazama, Introductory Lectures on the Theory of Relativity (in Japanese), Baifukan,1997.

【Prerequisite(s)】 Basic electromagnetic theory

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Superconductivity Engineering**

超伝導工学

【Code】10C613 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Mon 4th 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3 ~ 4	
	2 ~ 3	
	2 ~ 3	
	1 ~ 2	
	3 ~ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biological Function Engineering**

生体機能工学

【Code】 10C614 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Wed 2nd

【Location】 A1-001( 桂 1) 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tetsuo Kobayashi,Shoji Hamada,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basics of nervous system	2	
Neurons and glial cells	1	
Neuroimaging techniques	3	
Sensory functions	2	
Motor functions	1	
Basics of bio-electromagnetism	2	
Electromagnetic coupling to biological objects	2	
Transcranial magnetic stimulation	1	
Evaluation of understanding	1	

【Textbook】

【Textbook(supplemental)】 Tetsuo Kobayashi, Isamu Ozaki and Ken Nagata (eds.): "Brain topography and multimodal imaging", (Kyoto Univ. Press, 2009)

【Prerequisite(s)】 Electricity and magnetism, Fundamentals of biomedical engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Applied Hybrid System Engineering**

応用ハイブリッドシステム工学

【Code】10C621 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Wed 1st

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Takashi Hikihara, Shinji Doi, Yoshihiko Susuki, Syun'ichi Azuma,

【Course Description】 Many engineering systems show hybrid dynamical structure, which is accompanied with discrete change of vector flow by control and regulate the trajectory to target dynamically. In the course, the fundamental characteristics and theorems are lectured. The framework of hybrid system, automaton model, and singular perturbation theorem are explain. Dynamic quantizer, power system, and network are picked up as examples.

【Grading】 Exercise and repots are evaluated.

【Course Goals】 Students are requested to understand the characteristics of hybrid system, approaching method, and control methods.

## 【Course Topics】

Theme	Class number of times	Description
Fundamentals of hybrid system	4	As fundamentals, the definition of hybrid system and the method of modeling is explained.
Singular perturbation and asymptotic expansion	3	Singular perturbation theorema and asymptotic expansion are explained. For the global oscillation of singular perturbed system, analytical and geometrical singular perturbation methods are introduced.
Application of hybrid system-1: power system	3	The application to power system is explained. The outline of power system, then safety and examination, the stability analysis, and the modeling towards control are given.
Application of hybrid system-2: dynamic quantizer	2	As an application, dynamic quantizer is adopted. The outline of the dynamic quantizer, the analysis, and the design of the system are given.
Application of hybrid system-3: networking	3	As an application, the communication network is adopted. The internet network is also explained as an example of modeling and control.

【Textbook】 Each professors prepare the prints of lectures.

【Textbook(supplemental)】 No textbook.

【Prerequisite(s)】 Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This course is held every two years.

**Theory of Electric Circuits, Adv.**

電気回路特論

【Code】10C625 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Mon 2nd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Modeling by circuit	4	
Circuit equation	4	
Phenomena in circuit	3	
Property of circuit	2	
Achievement test	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Control Systems**

制御系設計理論

【Code】10C631 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】T. Hagiwara, Y. Ebihara

【Course Description】The course is based on State Space Theory of Dynamical Systems, and provides the applications of the concepts given therein to systematic control system design. The course covers such topics as state feedback and pole assignment, observers, synthesis of feedback control systems, servo conditions and feedforward, and optimal control under quadratic performance indices.

【Grading】In principle, the grading will be based on the absolute and comprehensive evaluation of the reports on the subjects given in the class. Should this change due to inadequate efforts on the submitted reports, an exam might be also imposed, in which case the details will be announced at the class at least two weeks before the exam term.

【Course Goals】To understand the basic ideas of control system design based on state space representations, and acquire fundamental knowledge and skills on practical control system design through simulated experiences with the report subjects.

## 【Course Topics】

Theme	Class number of times	Description
pole assignment by state feedback	4 ~ 5	state feedback, controllable canonical forms and pole assignment of scalar/multivariable systems, computation of the state feedback gains for pole assignment, transient responses, uncontrollable poles and stabilizability
observers	3 ~ 4	observable canonical forms and observability conditions, full-order observer, minimal-order observer, conditions for observers and observer-based feedback
synthesis of feedback systems	2 ~ 3	feedback systems with integral compensation, servo systems, internal model principle, synthesis of servo systems
optimal control under quadratic performance index	3 ~ 4	optimal regulators and their closed-loop poles, Riccati equations and their solutions, relationship with the pole assignment problem; Checking degrees of understanding of all the lecture topics closes the class.

【Textbook】Handouts will be given at the class.

【Textbook(supplemental)】

【Prerequisite(s)】The contents given in State Space Theory of Dynamical Systems, and linear algebra.

【Independent Study Outside of Class】

【Web Sites】(Info) <http://www-lab22.kuee.kyoto-u.ac.jp/~hagiwara/ku/matlab-octave.html>

【Additional Information】

**Electric Power Transmission System**

電力輸送システム

【Code】 10C616 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Computer Simulations of Electrodynamics

## 電磁界シミュレーション

【Code】 10C611 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Tue 5th

【Location】 A1-101/Electrical Engineering Bldg.-Lecture Room (M)/Uji Campus(Remote Lecture Room ) 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Variables and Classification of Simulation Codes	1	
Finite Difference Methods	1	
Difference Form of Maxwell's Equation and Grid Assignment / Time Step Chart	1	
Courant Condition	1	
Electromagnetic Radiation from a Thin Current	1	
Buneman-Boris Method for Equation of Motion (Relativistic Eqs.)	1	
Interporation of Electromagnetic Field	1	
Computatin of Charge and Current Densities, Self-force Cancellation	1	
Initilization of Particles and Fields	1	
Renormalization and Diagnostics	1	
Advection/Wave Equation for 1D Case (FTCS, Lax, Upwind and Lax-Wendroff Methods)	1	
von Neumann Stability Analysis	1	
Limiter Function	1	
Advection/Wave Equation for Multi-Dimensional Case	1	
Vlasov Equation	1	

【Textbook】

【Textbook(supplemental)】 (1) H. Matsumoto and Y. Omura, Computer Space Plasma Physics: Simulation Techniques and Softwares, Terra Scientific, Tokyo, 1993.

(2) H. Usui and Y. Omura, Advanced Methods for Space Simulations, Terra Pub, 2007.

【Prerequisite(s)】 Electrodynamics, Vector Analysis, Computer Language

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Space Radio Engineering

宇宙電波工学

【Code】 10C612 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 N1 lecture room in the Faculty of engineering building No. 3, A1-131 in Katsura campus, Uji

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hiroshi Yamakawa, Hirotsugu Kojima,

【Course Description】 The present lecture provides the guideline how the technology on the electronics and propulsion system is used for the development of spacecraft and space systems. Furthermore, in order to understand the environment in space, we also give a lecture on the space plasma physics.

【Grading】 attendance and final examination

【Course Goals】 Mastery of the way how we can make use of the knowledges of the physics and technology to the space engineering.

【Course Topics】

Theme	Class number of times	Description
Space environment	2	The space environment in the view point of spacecraft desing such as thermal condition, plasmas, and charging.
Spacecraft system and its related technology	5	The spacecraft system and its technology related to power system, communication system, EMC, and payload desings.
Spacecraft dynamics	3	Spacecraft orbit design and its attitude control
System engineering of spacecraft	4	Spacecraft propulsion system including the advanced systems which make use of solar power, GPS navigation system, and space debris
Feedback	1	We will give a feedback lecture by answering to questions from students.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Plasma physics, Electromagnetics. Radio engineering, Electronics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Applied Microwave Engineering**

マイクロ波応用工学

【Code】10C617 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 4th

【Location】(Katsura)A1-131, (Yoshida)N1, (Uji)S-143H 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】(RISH) Shinohara,(RISH) Mitani,

【Course Description】 This lecture picks up microwave power transmission (MPT) technology, rectifying antenna (rectenna), antenna and propagation for the MPT, microwave transmitters, and some MPT applications like the Space Solar Power Satellite/Station. This lecture also picks up the other wireless power transmission technologies like resonance coupling, energy harvesting, and applied microwave technologies of microwave processing, wireless communications, and radar.

【Grading】 Reports

【Course Goals】 Students learn about applied microwave engineering, mainly microwave power transmission.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, and review of microwave engineering are explained.
Applications of Wireless Power Transmission	3-4	Space Solar Power Satellite/Station and Ubiquitous power source as applications of microwave power transmission, the resonance coupling and energy harvesting as the other battery-less technologies are explained.
rectifying antenna (rectenna)	1-2	rectifying antenna (rectenna) for the MPT are explained.
antenna and propagation for the MPT	5-6	Calculation of beam collection efficiency and beam propagation with FDTD method are explained. Phased array technologies, beam targetting method, non linear physics of microwave-plasma interation are overiwied.
Microwave transmitters	2	High efficient semi-conductor amplifiers and microwave tubes are explained.
microwave processing, wireless communications, and radar	2	Microwave processing, wireless communications, and radar texhnologies are explained.

【Textbook】 Naoki Shinohara, "Solar Power Satellite (in Japanese)", ISBN978-4-274-21233-8, Ohm-Sya

【Textbook(supplemental)】 Naoki Shinohara and Kimiya Komurasaki, "Wireless Power Transmission Technologies - Inductive Coupling, Resonance Coupling and Microwave Power Transmission - (in Japanese)", ISBN978-4-904-77402-1, Kagaku-Gijutsu-Syuppan

【Prerequisite(s)】 Microwave engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Number of the lectures may change.

## Spacio-Temporal Media Analysis

時空間メディア解析特論

【Code】 10C714 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 工学部 3 号館 N1 教室・A1-131・宇治生存研講義室 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Yuichi Nakamura

【Course Description】 Representation, feature extraction, recognition of media with two or higher dimensions, especially images and videos, are explained with comparing to human vision and biological systems.

【Grading】 Evaluation is based on participation and reports.

【Course Goals】 To learn the basic of representation, feature extraction, and pattern recognition of signals with two or higher dimension, and their applications.

### 【Course Topics】

Theme	Class number of times	Description
Spatio-Temporal Media	1	What is spatio-temporal media. Some examples.
Light and Colors	1-2	Intensity, colors, and spectrum in image media.
Features and Segmentation	2	Features such as edge, region, etc. for analysing image media.
Filtering and Wavelet Transform	1-2	Introduction to filtering and Wavelet Transform.
Discrete Wavelet Transform and Applications	1-2	Discrete Wavelet Transform and applications such as image enhancement, image compression, etc.
Geometry of Image Capturing	1-2	The mechanism and geometry of image capturing: projection of a 3D world into 2D images.
3D Measurements and Reconstruction	2	3D measurements and 3D world reconstruction from a set of 2D images.
Measurement of Motions	1-2	Motion detection and measurement, and object tracking.
Pattern Recognition	0-2	The basic idea of pattern recognition and useful tools such as Support Vector Machine.

【Textbook】 No specific textbooks. Handouts will be given when necessary.

【Textbook(supplemental)】 Computer Vision: A Modern Approach, Forsyth and Ponce, Prentice Hall

【Prerequisite(s)】 Fundamental knowledge of digital signal processing

【Independent Study Outside of Class】

【Web Sites】 Please see Panda (<https://panda.ecs.kyoto-u.ac.jp/portal>).

【Additional Information】

**Visualized Simulation Technology**

可視化シミュレーション学

【Code】10C716 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 4th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2-3	
	1-2	
	1-2	
	2-3	
	2-3	
	1-2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Engineering Optics and Spectroscopy

光物理工学

【Code】 10G021 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Masahiro Hasuo, Taiichi Shikama

【Course Description】 Optics are widely used in many areas of modern science and technology. Students will learn the physical properties of light and light-matter interactions, and their applications. Topics such as light propagation in dielectric media, crystal optics, quantum optics, and lasers will be explored. Interactions of light with atoms, molecules and solids as examples will be also explored with introduction of the fundamentals of spectroscopy and their applications.

【Grading】 Grade evaluation will be based on report examination.

【Course Goals】 Understand the principles of optical engineering and spectroscopy.

Develop application abilities based on the principle understanding.

### 【Course Topics】

Theme	Class number of times	Description
Dispersion of light	6	propagation of light in dielectric media (Lorentz model), crystal optics, nonlinear optics
Quantum optics	1	quantum theory of light, principles of lasers
Light-matter interactions	5	light-induced transition, quantum states of atoms, molecules, and solids, and rules governing the transitions (selection rules)
Selection rules and group theory	2	introduction to group theory and its application to the selection rules
Confirmation of the achievement	1	

【Textbook】 Recommended books will be discussed in class.

【Textbook(supplemental)】 Lecture notes will be distributed.

【Prerequisite(s)】 Undergraduate-level electromagnetism and quantum mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physical Properties of Crystals Adv.**

結晶物性学特論

【Code】10C263 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Magnetism and magnetic materials**

磁性物理

【Code】10C271 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Micro Process and Material Engineering**

マイクロプロセス・材料工学

【Code】 10G203 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Kotera, O. Tabata, K. Eriguchi, I. Kanno, T. Tsuchiya,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Semiconductor microfabrication	3	
Thin-film process and evaluation	3	
Silicon micromachining	3	
3D lithography	3	
Soft-micromachining	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Quantum Science**

量子科学

【Code】 10C074 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】 This course involves fundamental interactions of electrons, ions and photons to atoms, molecules and condensed matters, and practical applications for nanotechnology. Great emphases are on fundamental mechanisms of beam-solid interactions, characterization techniques, material synthesis and processing for quantum devices with quantum beam. Recent progress of related area of quantum beam will be also introduced in this course.

【Grading】 Coursework will be evaluated with attendance and report on subjects.

【Course Goals】 To provide students to understand fundamental interactions in quantum science.

【Course Topics】

Theme	Class number of times	Description
Interactions between quantum beams and solids	7	Interactions between quantum beams and solids are described with various formulas. Collisions with nucleus, electronic excitation, defect formation and energy loss will be discussed and related scientific topics, such as discovery of electron will be introduced.
Applications of quantum beams	7	The interactions of quantum beam are widely used for various applications. Material processing and analysis with quantum beams are essential in nanotechnology and quantum beams are also important for diagnostics of diseases and cancer therapy in medical field. Practical applications will be presented with recent progress and challenges.
Final examination and report	1	Evaluation will be given by the contents of the reports and quizzes of the subjects leaned in this course.

【Textbook】 Ion-Solid Interactions: Fundamentals and Applications (Cambridge Solid State Science Series) M. Nastasi, J. Mayer, J. Hirvonen

【Textbook(supplemental)】

【Prerequisite(s)】 Solid state physics, Quantum mechanics(beginner ' s), Electromagnetism

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Materials**

分子機能材料

【Code】 10H413 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day &amp; Period】 Wed 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 A. Ito

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Materials Science**

分子材料科学

【Code】10H422 【Course Year】Master and Doctor Course 【Term】 【Class day &amp; Period】Wed 1st

【Location】A2-304 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kaji, Goto

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemistry of Polymer Materials**

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day &amp; Period】Fri 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Polymer Structure and Function

高分子機能学

【Code】 10H613 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 S. Ito, H. Ohkita, H. Aoki,

【Course Description】 Polymers are indispensable in our modern society, fundamental in industry, and functional for chemistry, medicine, electronics, and many other advanced and emerging technologies. In this class, photo- and electric functions of polymeric materials are discussed on the basis of photochemistry and photophysics. In particular, the importance of designing nanostructures of polymer assembly is highlighted by explaining examples of state-of-the-art real systems.

【Grading】 Evaluated with the grade on the final test or the quality of report submitted after the final class.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Conductive Polymers	2	
Photofunctional Polymers	3	
Nanostructure and Dynamics of Polymers	2	
Optoelectronic Polymers	3	

【Textbook】 None: Some handouts will be dealt in the class of every lecture.

【Textbook(supplemental)】 None:

【Prerequisite(s)】 Students are expected to have knowledge of Physical Chemistry and Polymer Chemistry provided in chemistry course of undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This lecture is held every other year, not offered in 2015.

**Digital Signal Processing, Advanced**

デジタル信号処理論

【Code】 693637 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 3rd

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Digital Communication Engineering**

デジタル通信工学

【Code】 693622 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	4	
	2	
	3	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Information Network**

情報ネットワーク

【Code】 693628 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,

【Course Description】 This course introduces architecture of information networks including communication protocol and layered structure. Various networks and their technologies, such as circuit switching network, IP network, photonic network, and mobile network, are explained.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 <http://www.i.kyoto-u.ac.jp/curriculum/syllabus.html>

**Recent Advances in Interdisciplinary Photonics and Electronics**

融合光・電子科学通論

【Code】 10X009 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 5th

【Location】 A1-131 【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar in Interdisciplinary Photonics and Electronics** ,

融合光・電子科学特別研修 1(インターソ)

【Code】 10X015 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Seminar in Interdisciplinary Photonics and Electronics** ,

融合光・電子科学特別研修 2(インターソ)

【Code】 10X017 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Research Internship (M,D)**

研究インターンシップ M(融合光)

【Code】 10X019 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Research Internship (M,D)**

研究インターンシップ D(融合光)

【Code】 10X021 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercises on Interdisciplinary Photonics and Electronics I, II**

融合光・電子科学特別演習 1

【Code】 10X023 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Exercises on Interdisciplinary Photonics and Electronics I, II**

融合光・電子科学特別演習 2

【Code】 10X025 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



## Exercise in Practical Scientific English

実践的科学英語演習

【Code】10i045 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】Thu 4th or 5th 【Location】A2-304 【Credits】1

【Restriction】Up to twenty students for each class 【Lecture Form(s)】Seminar 【Language】Japanese and English

【Instructor】Y. Nakayama and M. Nishi

【Course Description】Students learn about the basics of technical writing in English, and learn about and practice the format, style, and mechanics of the scientific research article. Students will also develop skills needed to create and deliver an effective presentation in English. We may restrict the class size to enhance learning. The course is shared by Master ' s and Doctoral Course students.

【Grading】Students are required to submit an initial report and a mid-term report, and make a final presentation in English. Students failing to submit the mid-term report or to make a presentation will be given no credit.

【Course Goals】Students develop basic communication skills needed to work for international organizations through practicing scientific English writing as well as presenting their research in English.

【Course Topics】

Theme	Class number of times	Description
Course Outline and Introduction to Technical Writing	1	Students examine the aim and requirements of the course, and look at the key points for writing correctly, clearly, and concisely. (The class schedule may change without notice.)
Basics of Technical Writing	2	Students learn about the definition and basic rules for technical writing, and look at common mistakes made by non-native writers of English.
Japanese-to-English Translation Practice	2	Students learn about English grammar and practice revising their English writing.
Paragraphs	2	Students learn about paragraphs: the topic sentence and supporting sentences, and techniques for sequencing information in a paragraph.
Format of Research Articles	2	Students learn about the standard format of a research article: the title and abstract
Listening Practice	1	Students practice listening comprehension using videos presenting scientific and technical information.
Presentation Practice	3	Students learn and practice techniques for delivering an effective presentation, and experience asking and answering questions.
Online Learning	2	Writing Paragraphs

【Textbook】No text – all materials are supplied by the teachers.

【Textbook(supplemental)】Yukiko Nakayama, Gijutsu kei Eibun Raithingu Kyohon (Technical Writing Textbook), Japan Society for Technical Communication

Anne M. Coghil and Lorrin R. Garson, The ACS style guide, 3rd, The American Chemical Society

【Prerequisite(s)】Students need to have basic English skills at undergraduate level.

【Independent Study Outside of Class】

【Web Sites】<http://www.glc.t.kyoto-u.ac.jp/ja/study/grad/10d040>

【Additional Information】We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance.

# Introduction to Advanced Material Science and Technology ( English lecture )

## 先端マテリアルサイエンス通論 ( 英語科目 )

【Code】10K001 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Fri 4th 【Location】KatsuraA2-308,Yoshida Research Bldg.No4,-Room3(Distance lectures)

【Credits】First term: 2, Spring term: 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】GL Edu. Center, J. Assoc. Prof., Tadao Mizuno  
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called "high technologies", and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 先端マテリアル講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Stress-Diffusion Coupling in Polymer Gels	1	Because a polymer gel in solvent forms a thermodynamic semi-open system, a mechanical stimulus imposed on the gel induces a thermodynamic response. The outline of this phenomenon is explained by using several examples. (4/10 T. Takigawa)
Modern Organic Synthesis for Material Science	1	The lecture will deliver recent developments in organic synthesis, particularly focusing on catalytic reactions that have revolutionized chemical processes, and their applications in the production of some important pharmaceuticals and organic materials. (4/17 Y. Nakao)
Oxide Magnetic Materials	1	Fundamentals of magnetism and magnetic properties of oxides as well as applications of magnetic oxide materials are described. A brief introduction to recent magnetics-related technologies such as spintronics is also given. (4/24 K. Tanaka)
In Vivo Optical and Photoacoustic Tumor Imaging using Near-infrared Dye-conjugated Amphiphilic Polymers	1	Optical and photoacoustic imaging methods are one of the most powerful and noninvasive techniques with which to visualize organs as well as tumor tissues. In this lecture, students can learn the basic principles of molecular imaging as well as recent progress in this field. (5/8 K. Ohe)
Photofunctional Nanocarbon Materials	1	Photo-functionalization of nanocarbon materials, e.g., fullerenes, carbon nanotubes, and graphenes, using the methodologies of organic synthetic chemistry and their application in photoelectrochemical devices. (5/15 T. Umeyama)
Rheology Control by Associating Polymers	1	Hydrophobically modified water-soluble polymers (associating polymers) have been used as rheology modifiers or thickeners because rheological properties of solutions and dispersions are drastically changed by the addition of small amounts of associating polymers. In this lecture, recent development on the molecular origin of the structure formation and rheological properties of associating polymers will be reviewed. (5/22 T. Koga)
Solar Hydrogen Production using Semiconductor Photocatalyst	1	The development of a clean and renewable energy carrier that does not utilize fossil fuels is a great technological challenge. Photocatalytic water splitting using semiconductor materials has attracted considerable interest due to its potential to cleanly produce H <sub>2</sub> from water by utilizing abundant solar light. In the present lecture, the basis and the recent progress in photocatalytic water splitting will be introduced. (5/29 R. Abe)
Hyperthermophiles and their thermostable biomolecules	1	This lecture will first introduce the diversity and classification of life. It will then focus on hyperthermophiles and their thermostable molecules, such as proteins, nucleic acids and lipids. (6/5 H. Atomi)
Physical Organic Chemistry of Supramolecular Photofunctional Organic Materials	1	This lecture explains interesting behaviors of photofunctional organic materials, such as photochromic compounds and fluorescence dyes, in the aggregated and self-organized state from the viewpoint of physical organic chemistry. (6/12 K. Matsuda)
Production of Advanced Materials by Micro Chemical Plants	1	This lecture will concentrate on the following topics related to the micro chemical processes. 1) Feature of micro devices, 2) Possibility of using micro systems for real production, 3) Design problems of micro chemical plants, 4) Control of micro chemical plants, 5) Blockage detection of parallelized micro plants, 6) Future direction of the research on micro chemical plants. (6/19 S. Hasebe)
Directed Self-Assembly (DSA) of Block Copolymers	1	Recently, Directed Self-Assembly (DSA) technology of block copolymers has received a lot of attention in the field of semiconductor research. In this lecture, the fundamentals of microphase separation of block copolymers and the application of DSA to lithographic technologies will be reviewed. (6/26 T. Koga)
High-temperature superconductor as a playground for the macroscopic quantum phenomena	1	High temperature superconductors have attracted much attention to their emerging mechanism and applications. They are also quite peculiar for playgrounds for superconducting properties as macroscopic quantum phenomena. In this lecture, quantum phenomena found in high temperature superconductors and their applications are discussed. (7/3 I. Kakeya)
Introduction to Nuclear Materials	1	Nuclear materials are designed for good performance in irradiation field of neutron and high-energy particles. Fundamentals and some examples of nuclear reactions with these particles will be talked. (7/10 I. Takagi)
Materials Processing using external fields for microstructure control	1	Properties of materials are not simply determined by atomic structure and chemical composition. Microstructure (crystal grain size, crystallographic orientation and so on) significantly influences the properties. Not a few techniques have been developed for controlling the microstructure. Materials processing using external fields will be demonstrated in this class. (7/17 H. Yasuda)
Electrodeposition and Electroless Deposition for Materials Processing	1	(1) Fundamentals chemistry, electrochemistry, and thermodynamics, and (2) applications of electrodeposition and electroless deposition for materials processing. (7/24 K. Murase)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Check the notice on the bulletin board.

Students who take Spring term (Lecture code 10H012) should attend first 11 lectures.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.

**Human Security Engineering**

人間安全保障工学概論

【Code】10X301 【Course Year】Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 5th 【Location】C1-171

【Credits】2 【Restriction】 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 MATSUOKA Yuzuru, MONNAI Teruyuki, OHTSU Hiroyasu, TANAKA Hiroaki, TATANO Hirokazu, KOBAYASHI Kiyoshi, MATSUSHITA Kazuo,

【Course Description】 This lecture aims to get student to comprehensively and deeply understand issues related to "Human Security Engineering" as a system of technologies for designing and managing cities that enable inhabitants to live under better public health conditions, and environmental destruction, as listed in the Millennium Development Goals from the viewpoint of four existing fields, i.e. urban governance, urban infrastructure management, health risk management, and disaster risk management. In addition, we'll provide lectures on this new discipline systematically based on the relationship between four existing fields.

【Grading】 Participation, Presentation, and Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Orientation	1	
Tentative Overview of Human Security Engineering	1	
Urban Governance	2	
Urban Infrastructure Management	2	
Health Risk Management	2	
Disaster Risk Management	2	
Human Security and Environmental Security	1	
Human Right, Property and Social Capital	1	
Poverty Traps	1	
Discussion on Human Security Engineering	1	
Evaluation and Report	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://hse.gcoe.kyoto-u.ac.jp/en/inside/kyomu/index.html>

【Additional Information】

**Urban Governance**

都市ガバナンス論

【Code】 10X303 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Fri 3rd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,

【Course Description】 The key to raising the human quality of life lies in well-designed cities that make good use of human and physical resources. In this course, we will explore the methodology of urban governance, including bottom-up decision making based on collaboration of various actors, in order to solve the multi-dimensional human security problems of safety, health, convenience, comfort, amenity, and sustainability. Moreover, multiple lecturers will provide interesting topics of urban governance, with concrete problems for students to discuss.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	4	
	2	
	1	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Lectures in Urban Governance 1**

都市ガバナンス学各論 1

【Code】 10X305 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Supervisor

【Location】 Supervisor 【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】

【Course Description】 This class will cover the hot topics on urban governance within human security engineering. Instructors will present current literature and expect students to develop arguments.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Tailor-made lectures by supervisor

**Lectures in Urban Governance 2**

都市ガバナンス学各論 2

【Code】 10X307 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Supervisor

【Location】 Supervisor 【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】

【Course Description】 In this class, research topics related to urban governance within human security engineering will be assigned to students to enable them to solve human security problems. The students are required to review the latest or important fundamental papers, including related areas, and debate ideas with their teachers.

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Tailor-made lectures by supervisor

## Urban Infrastructure Management

都市基盤マネジメント論

【Code】 10X311 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 OHTSU Hiroyasu,

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoints of not only economy but also “ human security engineering ” . In detail, the contents of lectures consist of following topics: Urban Infrastructure Asset Management, Urban Transport/Logistics Management and Urban Food/Water Supply Management.

【Grading】 Attendance(20), Report(80)

【Course Goals】 Aquisition of interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoint of not only economy but also "human security engineering".

【Course Topics】

Theme	Class number of times	Description
Guidance, Introduction of Urban Infrastructure Asset Management	1	Guidance & Introduction to Urban Infrastructure Asset Management
Urban Infrastructure Asset Management	5	Urban Infrastructure Asset Management on Geotechnical structures, Bridge and Pavement
Urban Transport/Logistics Management	4	Urban Transport/Logistics Management
Urban Energy Supply Management	3	Urban Energy Supply Management
Report	1	Report
Feed back	1	Feed back

【Textbook】

【Textbook(supplemental)】 Hand-out

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Lectures in Urban Infrastructure Management 1**

都市基盤マネジメント学各論 1

【Code】 10X315 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Lectures in Urban Infrastructure Management 2**

都市基盤マネジメント学各論 2

【Code】 10X317 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Lecture on Environmental Management Leader

## 環境リスク管理リーダー論

【Code】10X321 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th 【Location】C1-171 【Credits】2 【Restriction】

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】TANAKA Hiroaki,SHIMIZU Yoshihisa,FUJII Shigeo,

【Course Description】In this class, we ' ll give lectures on theory of risk analysis, risk identification, risk assessment, risk evaluation, and risk reduction and avoidance in the field of urban human security including human health risk and ecological risk. The main purpose of this lecture is to provide students basic viewpoint and knowledge required for environmental leaders who can practically solve environmental issues occurring in developing countries, showing several international environmental projects as practical case works.

【Grading】Participation, Oral and Poster Presentation, and Report

【Course Goals】The main purpose of this lecture is to provide students with the basic viewpoint and knowledge required for environmental leaders able to practically solve environmental issues occurring in developing countries, focusing on several international environmental projects as practical case works.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	In this introductory lecture, the current situation and problems of the environment in Asian developing countries are explained, and basic ideas for their improvement measures are given together with fundamental terminologies.
Energy and Environment	1	
View point and commitment to rural environmental issues	1	
Disaster Risk Management and Grass-roots International Cooperation	1	
Environmental Risk Assessment and Risk Communication	1	
Water, Sanitation and Solid Waste Management for Developing Countries	1	
Presentations and Discussions	2	
Japan's Lessens on Economy & Development	1	
Solid Waste Management	1	
Ensuring Sustainability in Water Supply and Sewerage Sector	1	
Water Supply and Human Security	1	
Impending Issues in Lake Biwa-Yodo River Water Management and the Basin Governance	1	
Environment & Sanitary Engineering Research International Session	1	
Poster Presentation in Environment & Sanitary Engineering Research Symposium	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】To be announced at class about poster presentation in Environment & Sanitary Engineering Research Symposium.

**Lectures in Health Risk Management 1**

健康リスク管理学各論 1

【Code】 10X323 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Lectures in Health Risk Management 2**

健康リスク管理学各論 2

【Code】 10X325 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Management of Global Resources and Ecosystems

## 地球資源・生態系管理論

【Code】 733103 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd

【Location】 Main Lecture Room, Research Bldg. No.5, Yoshida Campus 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 Shinnya Funakawa, Shozo Shibata, Yo Yamashita

【Course Description】 Considerations of how terrestrial and aquatic ecosystems are structured, work, and respond what is done to and around them. Provides basis for understanding world's ecosystems and assists students in evaluating alternatives and in making wise decisions regarding world's ecology and resource management.

【Grading】 Evaluated by the sum of scores of mid-term quizzes and reports (50%) and end-of-term report (50%).

【Course Goals】 At the end of this class, students are required to understand basic ecological processes in terrestrial and aquatic ecosystems as a basis for studying further global environmental issues.

### 【Course Topics】

Theme	Class number of times	Description
Large-scale Pattern of Climatic Variation	1	Large-scale Pattern of Climatic Variation Given by Prof. Funakawa
Energy transformation and nutrient cycling in terrestrial ecosystems	1	Energy transformation and nutrient cycling in terrestrial ecosystems Given by Prof. Funakawa
Soil and Soil Ecosystem	1	Soil and Soil Ecosystem Given by Prof. Funakawa
Ecological resources and their utilization under humid climatic conditions	1	Ecological resources and their utilization under humid climatic conditions Given by Prof. Funakawa
Ecological resources and their utilization under arid and semi-arid climatic conditions	1	Ecological resources and their utilization under arid and semi-arid climatic conditions Given by Prof. Funakawa
Forests and forest ecosystem	1	Forests and forest ecosystem Given by Prof. Shibata
Forest environment	1	Forest environment Given by Prof. Shibata
Forest destruction and restoration	1	Forest destruction and restoration Given by Prof. Shibata
Forest and Forestry	1	Forest and Forestry Given by Prof. Shibata
Management of forest resources	1	Management of forest resources Given by Prof. Shibata
Oceanic environments and biological production system	1	Oceanic environments and biological production system Given by Prof. Yamashita
Ecology of aquatic animals	1	Ecology of aquatic animals Given by Prof. Yamashita
Anthropogenic impacts on coastal ecosystem	1	Anthropogenic impacts on coastal ecosystem Given by Prof. Yamashita
Ecosystem and fisheries resources	1	Ecosystem and fisheries resources Given by Prof. Yamashita
Management of fisheries resources	1	Management of fisheries resources Given by Prof. Yamashita

【Textbook】 Not specified.

【Textbook(supplemental)】

【Prerequisite(s)】 Not specified.

【Independent Study Outside of Class】 Students are required to study on each of the topics after lecture by using the materials distributed.

【Web Sites】

【Additional Information】

## Environmental Ethics and Environmental Education

環境倫理・環境教育論

【Code】 733104 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 5th

【Location】 Main Lecture Room, Research Bldg. No.5, Yoshida Campus 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 Rajib Shaw, Jane Singer

【Course Description】 Ethical approaches and educational activities are essential for solving environmental problems, especially to facilitate consensus building among conflicting stakeholders. This course covers prominent schools of thought in the field of environmental ethics, and broader aspects of environmental education, including education for sustainable development, climate change education and disaster risk reduction education. The purpose is to deepen students' theoretical understanding and practical competencies based on case studies, fieldwork and in-class exercises.

【Grading】 Attendance, proactive participation in class discussion and group exercises, class assignments, campus activities, and group presentations

【Course Goals】 To realize and deepen understanding on the linkage between the class room learning and practical approaches in the field

### 【Course Topics】

Theme	Class number of times	Description
Introduction (Shaw and Singer)	1	Week 1: Overview, introduction and evolution of concepts
Part I: Environmental ethics (Singer)	4	Week 2: Basic ethical concepts
		Week 3: History of environmental movement
		Week 4: Animal and food issues
		Week 5: Ethics of water, agriculture and development
Part II: Environment, disaster and climate change education (Shaw)	3	Week 6: Basics of environmental education
		Week 7: Basics of disaster risk reduction education
		Week 8: Basics of climate change education
Part III: Advocating for sustainability on campus and beyond (Gannon and Singer)	3	Week 9: Campus and community sustainability
		Week 10: Skills for sustainability communication and advocacy
		Week 11: Fieldwork
Ethics of water, agriculture and development	4	Week 12: Group presentations
		Week 13: Group preparations
		Week 14: Group presentations
		Week 15: Feedback session

【Textbook】 • Environmental Ethics: An Anthology, A. Light and H. Rolston III, (Blackwell Publishing)

- Ecological Literacy: Educating our Children for a Sustainable World, D.W. Orr, (Sierra Club Books)
- Disaster Education, Rajib Shaw, Koichi Shiwaku, Yukiko Takeuchi, (Emerald Group Publishing )
- Education and Climate Change: Living and Learning in Interesting Times, Fumiyo Kagawa and David Selby, (Routledge)
- Sustainability on Campus: Stories and Strategies for Change (Urban and Industrial Environments), Peggy F. Barlett and Geoffrey W. Chase, (The MIT Press)

- Environmental Communication and the Public Sphere, Robert Cox, (SAGE Publications)

- The Sustainable University: Progress and prospects, Stephen Sterling, (Routledge in Sustainable Development)

【Textbook(supplemental)】 • ESD Toolkit: Web resources [http://www.esdtoolkit.org/resources/web\\_esd.htm](http://www.esdtoolkit.org/resources/web_esd.htm)

- Education for Sustainable Development: Challenges, Strategies and Practices in a Globalizing World, Anastasia Nikolopoulou, Taisha Abraham, Farid Mirbagheri, (SAGE Publications)

【Prerequisite(s)】 Not specified

【Independent Study Outside of Class】 There is no specific required text. Learning materials will be distributed during orientation and each class.

【Web Sites】

【Additional Information】

## Disaster Risk Management

### 災害リスク管理論

【Code】10X333 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th 【Location】C1-171  
 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】English 【Instructor】TATANO Hirokazu, YOKOMATSU Muneta,

【Course Description】 Natural disasters have low frequencies but high impacts. It is very important to make an integrated risk management plan that consists of various countermeasures such as prevention, mitigation, transfer, and preparedness. This class will present economic approaches to natural disaster risk management and designing appropriate countermeasures.

【Grading】 Evaluate mainly by the presentations in the class as well as end-of-term report, taking active and constructive participation in the class into account.

【Course Goals】 Students are expected to understand fundamental ways of economic analyses of disaster prevention such as economic valuation of disaster losses, decision making principle under risks, derivation of benefits of risk management.

#### 【Course Topics】

Theme	Class number of times	Description
Introduction to disaster risk management	1	Introduction and Explanation of Course Outline, The Global Trends of Natural Disasters
1. Decision making theory under uncertainty	1	Bayes' theorem, Expected utility function
Methods of disaster risk management	1	Risk control and risk finance
Economic valuation of catastrophic risk mitigation	1	Cost-Benefit analysis, conventional valuation method, catastrophic risks and economic valuation of disaster mitigation
Risk perception bias, land-use and risk communication	2	Risk perception bias, land-use model, risk communication
Disaster risk finance	2	Recent issues of risk finance market, reinsurance, CAT bond, roles of government, derivatives
Risk curve and risk assessment	1	Fragility curve and risk assessment
General equilibrium analysis under disaster risk	1	General equilibrium model under disaster risk
Macrodynamics under disaster risk	1	GDP, economic growth
Disaster accounting	1	Accounting systems
Exercise and presentation	2	Students' exercise and presentation
Confirmation of the learning achievement degree	1	Confirmation of the learning achievement degree

【Textbook】 Tatano,H., Takagi,A.(ed.):Economic Analysis of disaster prevention, Keiso pub.,2005 (in Japanese).

【Textbook(supplemental)】 Froot ,K.A.(ed) “ The Financing of Catastrophic Risk ” , the University of Chicago Press Kunreuther H. and Rose, A., “ The Economics of Natural Hazards ” , Vol.1 & 2, The International Library of Critical Writings in Economics 178, Edward Elgar publishers, 2004

Okuyama, Y., and Chang, S.T.,(eds.) “ Modeling Spatial and Economic Impacts of Disasters ” (Advances in Spatial Science), Springer, 2004.

【Prerequisite(s)】 Nothing

【Independent Study Outside of Class】

【Web Sites】 No web site

【Additional Information】

**Lectures in Disaster Risk Management 1**

災害リスク管理学各論 1

【Code】 10X335 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Lectures in Disaster Risk Management 2**

災害リスク管理学各論 2

【Code】 10X337 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship for Human Security Engineering**

人間安全保障工学インターンシップ

【Code】 10X339 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Capstone Project**

アドバンスド・キャップストーン・プロジェクト

【Code】 10X341 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 8 【Restriction】 【Lecture Form(s)】 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Human Security Engineering Seminar A**

人間安全保障工学セミナー A

**【Code】**10X351 **【Course Year】**Master Course **【Term】**1st+2nd term **【Class day & Period】**Up to each supervisor**【Location】**Up to each supervisor **【Credits】**4 **【Restriction】**5 years type students only **【Lecture Form(s)】**Seminar**【Language】** English **【Instructor】** Relevant teachers,**【Course Description】** In the style of seminar, each student is given a theme for research related to human security problem to be solved by engineering methods, and the understanding on such a problems will be deepen from a specialized viewpoint of each student. Each student will get individual guidance by the supervisor about the method of the study on the problem or the collection method of the related information. Reports and presentation will be assigned after discussion with the supervisor.**【Grading】** Grade is evaluated comprehensively by the supervisor.**【Course Goals】** To master the practical method to approach actual problems related to human security engineering.**【Course Topics】**

Theme	Class number of times	Description
Tutorial by Seting up of reseach problem, discussion, presentation, etc.		

**【Textbook】** Not appointed. Research papers will be given if necessary.**【Textbook(supplemental)】** It will be introduced any time if necessary.**【Prerequisite(s)】****【Independent Study Outside of Class】****【Web Sites】****【Additional Information】**

**Human Security Engineering Seminar B**

人間安全保障工学セミナー B

【Code】10X352 【Course Year】Master Course 【Term】1st+2nd term 【Class day &amp; Period】Up to each supervisor

【Location】Up to each supervisor 【Credits】4 【Restriction】5 years type students only 【Lecture Form(s)】Seminar

【Language】English 【Instructor】Relevant teachers,

【Course Description】 In the style of seminar, each student is given a theme for research related to human security problem to be solved by engineering methods, and the understanding on such a problems will be deepen from a specialized viewpoint of each student. Each student will get individual guidance by the supervisor about the method of the study on the problem or the collection method of the related information. Reports and presentation will be assigned after discussion with the supervisor.

【Grading】 Grade is evaluated comprehensively by the supervisor.

【Course Goals】 To master the practical method to approach actual problems related to human security engineering.

【Course Topics】

Theme	Class number of times	Description
Tutorial by Seting up of reseach problem, discussion, presentation, etc.		

【Textbook】 Not appointed. Research papers will be given if necessary.

【Textbook(supplemental)】 It will be introduced any time if necessary.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Infrastructural Structure Engineering

社会基盤構造工学

【Code】 10W001 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Related Faculty members,

【Course Description】 Structural engineering problems related to planning, design, construction and maintenance of the infrastructures are discussed. Topics concerning structural engineering and management are widely taken up including latest advanced knowledge and technology, future view and/or international topics. Special lectures by extramural lecturers are carried out if necessary.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To grasp problems related to structural engineering and their specific solutions.  
To understand applicability of advanced technologies and development prospects.

### 【Course Topics】

Theme	Class number of times	Description
Structural Materials, Structural Mechanics	4	Steel materials, Concrete materials, mechanical behavior of structures, Problems related to design, construction and maintenance
Applied Mechanics	1	Numerical analysis for structure performance evaluation
Earthquake and Wind Resistance of Structures	7	Infrastructure and natural disaster, Trends of disaster prevention technology, Problems related to Earthquake and wind resistant design
Maintenance of structure	3	International technology, Scenario design, International technological education and collaboration

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Supplemental text books will be introduced by instructors.

【Prerequisite(s)】 Structural Mechanics, Wind Resistant Design, Construction Materials, Dynamics of Structures, etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Hydraulic Engineering for Infrastructure Development and Management

水域社会基盤学

【Code】10F065 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd  
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Hosoda Takashi, Toda Keichi, Gotoh Hitoshi, Tachikawa Yasuto, Kishida Kiyoshi, Ichikawa Yutaka,  
 Harada Eiji, Sanjou Michio, Khayyer Abbas and Kim Sunmin,

【Course Description】 This lecture picks up various water-related problems and provides their explanation and solution methodology related to hydrodynamic and hydrological infrastructure improvements, maintenance, disaster prevention against flood and damage of water environment, interweaving several leading-edge cases in the real world. Turbulent flow and CFD, sediment transport system and design/planning of hydraulic structure are described on the basis of the integrated management of river-and-coast systems with sediment control and these relationship with infrastructure improvement. Perspective from the viewpoint of public environmental infrastructure on water environment is presented.

【Grading】 Grading is based on students activities in lectures and reports.

【Course Goals】 Students learn about case-based practical solutions against various problems related to hydraulic engineering, and students acquire academic preparation of how to approach to public environmental infrastructure on water area.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Hydraulics in open-channel flows	3	Several problems and exciting topics related to hydraulics in open-channel flows are discussed with advanced practical examples.
River basin management	3	Introduction of flood disasters during a few decades in the world, flood control planning in Japan, Economic evaluation and analysis of people ' s awareness to river improvement projects with dam construction.
Beach erosion	3	Several problems and their solution methodology against sediment transport process in coastal zone are explained. Advanced approaches for sediment control are overviewed.
Rainfall-runoff prediction and hydrologic design	3	Water resources issues related to rainfall-runoff prediction and hydrologic design are discussed with advanced practical examples.
Numerical simulation for Hydraulic engineering	1	Recent numerical simulation development and related state-of-the-art technologies are overviewed.
Achievement Confirmation	1	Comprehension check of course contents.The exercises to the given subjects are performed.

【Textbook】 Non

【Textbook(supplemental)】 Non

【Prerequisite(s)】 hydraulics, fluid mechanics, river engineering, coastal engineering, hydrology, etc.

【Independent Study Outside of Class】

【Web Sites】 Non

【Additional Information】 Non

## Structural Stability

構造安定論

【Code】 10F067 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd  
 【Location】 C1-171 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English  
 【Instructor】 Hiromichi SHIRATO, Kunitomo SUGIURA,

【Course Description】 Fundamental concept of static and dynamic stability of large-scale structures such as bridges is to be introduced in addition to the way to keep/improve their safety and to evaluate their performance. Basic concept of structural stability and its application and technical subjects to improve safety will be lectured systematically. Furthermore, the practical solutions to the subjects are to be introduced to assure the safety of structures.

【Grading】 Grading will be evaluated by written examination, reports and attendance.

【Course Goals】 The class aims to cultivate the understanding of static and dynamic stability problems for structural system and make understand the methodology to clarify the limit state. To get knowledge on countermeasures to assure the stability which is applicable to practical design and manufacturing will be also required.

### 【Course Topics】

Theme	Class number of times	Description
Elastic Stability under Static Loading	7	Stability of Structures and Failures Basis of Structural Stability Elastic Buckling of Columns Elastic Buckling of Beams & Frames Elastic Buckling of Plates Elasto-plastic Buckling Buckling Analysis
Basic theory of dynamic stability and its application	7	The stability around the equilibrium points based on the state equation of motion in which the nonlinearity of external, damping and restrig forces are taken into account. Wind-induced vibration of a square prism (Galopping) and 1dof system with nonlinear spring will be introduced as practical examples. Chaotic motion of a pendulum subjected to periodic external force is also explained as an introduction of chaos theory.
Achievement Check	1	Summary and Achievement Check.

【Textbook】 Not specified.

【Textbook(supplemental)】 Introduced in class if necessary.

【Prerequisite(s)】 It is desired for participants to master structural mechanics, continuum mechanics, mathematical analysis as well as vibration theory.

【Independent Study Outside of Class】

【Web Sites】 none

【Additional Information】 none

## Material and Structural System & Management

材料・構造マネジメント論

【Code】 10F068 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Hirotaka Kawano, Atsushi Hattori, Takashi Yamamoto,

【Course Description】 With regard to the maintenance of concrete structures, the deterioration prediction procedures in material and structural properties are discussed based on durability and deterioration processes of concrete structures. Repair materials and methods are also introduced. Note: strengthening materials and methods are discussed in Concrete Structural Engineering, provided in the second semester. In the later half of this lecture, structures are focused as groups rather than an individual structure to understand the difference between asset management and maintenance. By taking into consideration the economic aspect and human resources aspect as well as the physical aspect, the flow of the asset management for structures' groups with view points of the life cycle cost and the budget is provided.

【Grading】 Reports ,presentations and other activities are inclusively considered.

【Course Goals】 To understand the maintenance for a single structure and the asset management for structures' group.

### 【Course Topics】

Theme	Class number of times	Description
1. Outline of maintenance for concrete structures	1	
2. Deterioration mechanisms of concrete structures and deterioration prediction	4	
3. Repair materials and methods for concrete structures	1	
4. Maintenance and asset management	2	
5. Maintenance for structures' group	2	
6. Management for structures' group	2	
7. Presentations and discussions	3	

【Textbook】 Not specified. Some materials may be provided.

【Textbook(supplemental)】 Not specified.

【Prerequisite(s)】 Basic knowledge on Construction Materials and Concrete Engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Positive presence in the lecture is expected by joining discussions for example.

## Computational Fluid Dynamics

数值流体力学

【Code】 10F011 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Satoru Ushijima, Hitoshi Gotoh, Abbas Khayyer,

【Course Description】 Computational Fluid Dynamics (CFD) is largely developed according to the progress of computer technology in recent years. It is the powerful and effective technique to predict the various fluid phenomena, which show the complicated behaviors due to the non-linearity and other conditions. This course provides the dynamics of fluids and eddies as well as the discretization and numerical techniques, such as finite difference, finite volume and particle methods.

【Grading】 The grading will be based on homework assignments.

【Course Goals】 Course goal is to understand the basic theory and numerical techniques for CFD.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of recent examples of CFD
computational method for incompressible fluids	7	The course introduces the MAC algorithm, which is generally used for incompressible Newtonian fluids on the basis of finite difference and finite volume methods (FDM and FVM). The outline of numerical methods is also discussed for parabolic, hyperbolic or elliptic partial differential equations, in terms of the numerical stability and accuracy. Homework will be assigned each week.
Particle method - basic theory and improvements	7	To simulate violent flow with gas-liquid interface which is characterized by fragmentation and coalescence of fluid, particle method shows excellent performance. Firstly, basics of the particle method, namely discretization and algorithm, which is common to SPH(Smoothed Particle Hydrodynamics) and MPS(Moving Particle Semi-implicit) methods, are explained. Particle method is superior in robustness for tracking complicated interface behavior, while it suffers from existence of unphysical fluctuation of pressure. By revisiting the calculation principle of particle method, various improvements have been proposed in recent years. In this lecture, the state-of-the-art of accurate particle method is also described.

【Textbook】 No textbook assigned to the course

【Textbook(supplemental)】 Recommended books and papers will be introduced in the course.

【Prerequisite(s)】 Basic knowledge of fluid dynamics, continuum mechanics and computational technique

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Earthquake Engineering/Lifeline Engineering**

地震・ライフライン工学

【Code】 10F261 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 4th

【Location】 C1-191 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Kiyono,Igarashi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
Principles of seismic design of structures	2	Fundamental theories on dynamic response of nonlinear elastoplastic structural systems and representative seismic design principles
Seismic performance of concrete and steel structures	1	Essentials and current issues related to seismic performance and design of RC and steel structures
Seismic response control and seismic retrofit of structures	1	Idea and current issues on seismic isolation, seismic response control techniques for enhancement of seismic performance of structures, and seismic retrofit and rehabilitation of existing structures
	1	
	2	
	1	
	1	
Achievement evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Applied Hydrology**

応用水文学

【Code】10F100 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Tomoharu Hori, Tetsuya Sumi, Shigenobu Tanaka, Yasuhiro Takemon, Kenji Tanaka, Sameh Kantoush

【Course Description】Applied and integrated approach to the problems closely related to the water circulation system, such as floods, droughts, water contamination, ecological change, and social change is introduced mainly from the hydrological viewpoint with reference to water quantity, quality, ecological and socio-economic aspects. In the course, several actual water problems are taken up and solving process of each problem which comprises of problem-identification and formulation, impact assessment, countermeasures design and performance evaluation is learned through the lectures' description and also investigation and discussion among the students.

【Grading】Grading is based on student activities in lectures, presentation and reports

【Course Goals】To obtain fundamental Knowledge and skills to perform problem definition, survey and countermeasure design on problems about water use, water hazard mitigation and water environment.

## 【Course Topics】

Theme	Class number of times	Description
Water disasters and risk management	2	Risk assessment of water disasters, countermeasures and adaptation design, water disasters and human security
Reservoir Systems and Sustainability	2	Reservoir system and its environmental impacts, Sustainable management of reservoir system
Hydrological Frequency Analysis	3	Basic theory and application of Hydrological Frequency Analysis, which is the basis for hydrologic design.
Land Surface Processes	2	Modelling of land surface processes, Application of land surface model
Management of Large and Transboundary River Basins	2	Hydrological measurements of large river basins, Applications of hydrological modeling in of transboundary river basins
Hydro-eco Systems	2	Ecohydrological management of habitats in river ecosystems, Ecohydrological management of biodiversity in wetland ecosystems
Presentation and Discussion	2	Presentation and Discussion on related topics

【Textbook】Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】None

【Prerequisite(s)】Elementary knowledge of hydrology and water resources engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Case Studies Harmonizing Disaster Management and Environment

### Conservation

環境防災生存科学

【Code】 10F103 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 K. TAKARA(DPRI), H. NAKAGAWA(DPRI), E. NAKAKITA(DPRI), H. MASE(DPRI), N. MORI(DPRI), Y. YAMASHIKI(DPRI),

【Course Description】 Environmental impacts by infrastructure for disaster prevention and mitigation are discussed.

Introducing various examples of natural disasters, degradation of the environment, and harmonizing disaster management and environmental conservation in the world, this classroom carries on a dialogue about effective measures for reducing negative environmental impacts and serious disasters.

【Grading】 Considering both the number of attendances and the score of final test at the end of the semester.

【Course Goals】 Conservation of the environment and prevention/mitigation of natural disasters, which are very important for human's survivability, often conflict with each other. This course introduces various examples. Students will learn many examples harmonizing these two issues, and shall consider technical and social countermeasures fitting to the regional characteristics.

#### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
Disaster due to heavy rainfall -- utilization of weather radar and global climate change	3	Disaster due to heavy rainfall -- utilization of weather radar and global climate change
Flood disaster prevention and the environment	2	Flood disaster prevention and the environment
River environment and disaster management	2	River environment and disaster management
The environment of closed water areas / Atmosphere-ocean climate interaction	2	The environment of closed water areas / Atmosphere-ocean climate interaction
Coastal disasters due to tsunamis and storm surges	2	Coastal disasters due to tsunamis and storm surges
Projection of climate and coastal environmental change	2	Projection of climate and coastal environmental change

【Textbook】 No particular textbook for this course. Necessary documents and literature introduction are provided in the class room from time to time.

【Textbook(supplemental)】 Some literature would be introduced by professors.

【Prerequisite(s)】 No special knowledge and techniques are necessary, but requires reading, writing and discussing in English in the class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Contact Prof. Takara at <takara.kaoru.7v@kyoto-u.ac.jp> if you have any query.

# Integrated Disasters and Resources Management in Watersheds

流域管理工学

【Code】10F106 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 1st

【Location】Katsura Campus, Ujigawa Open Laboratory, Shirahama Oceanographic Observatory and Hodaka Sedimentation Observatory

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture and Exercise 【Language】English

【Instructor】Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Nozomu YONEYAMA(DPRI), Kenji KAWAIKE(DPRI), Hiroshi TAKEBAYASHI(DPRI), Daizo TSUTSUMI(DPRI), Yasuyuki BABA(DPRI),

【Course Description】Mechanism and countermeasures of sediment disasters, flood disasters, urban flood disasters and coastal disasters are explained. An integrated watershed management of these disasters and water/sediment resources is also introduced. This lecture will be open at Katsura Campus, Ujigawa Open Laboratory, Shirahama Oceanographic Observatory and Hodaka Sedimentation Observatory. Students attending this lecture must take one of the intensive experiment/field study courses offered in Ujigawa Open Laboratory and these observatories.

【Grading】Presentation, Discussion and Report

【Course Goals】Learn an integrated basin management system for natural disasters (sediment disasters, food disasters, coastal disasters, urban flood disasters) mitigation and water/sediment resources utilization considering environmental conservation.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Contents of this lecture are explained.
Urban flood disaster managemnet	2	We review urban floods from the viewpoint of river basins, flood causes, and features, together with the results of recent studies. Based on these studies, we propose comprehensive measures against urban floods, including underground inundations. In addition, we discuss on prediction methods of the tsunami disaster in urban area.
Flood disaster management	2	Prevention / mitigation measures against flood disasters and flood prediction methods are explained as well as examples of recent flood disasters in Japan.
Sediment disaster management	2	Showing the problems on sediment disasters and sediment resources, I explain an integrated sedimnet management system both for sediment disasters and sediment resources.
Coastal disaster management	2	Coastal erosion and tsunami hazard become remarkable in these days in Japanese coast. In a lecture, we discuss on characteristics of such coastal disasters.
Exercise on flood disaster at Ujigawa Open Laboratory (Selective)	6 (集中2日間)	Experiment and analysis on debris flows, riverbed variation and flooding at Ujigawa Open Laboratory, Fushimi-ku, Kyoto city.
Exercise on sediment related disaster at Hodaka Sedimentation Observatory (Selective)	6 (集中2日間)	The Hodaka Sedimentation Observatory is located at Okuhida region, Gifu Prefecture. In the field exercise, observation methods of rainfall-runoff and sediment movement processes will be explained. Field investigations into several types of erosion control facilities, sediment producing sites, debris flow sites and sediment related disaster sites will be carried out.
Exercise on coastal disaster at Shirahama Oceanographic Observatory (Selective)	6 (集中2日間)	The Shirahama Oceanographic Observatory is located in Shirahama, Wakayama Prefecture. In the lecture, the observatory, waves, currents and tide levels monitoring system is demonstrated as well as the observation tower and the observation boat.

【Textbook】None

【Textbook(supplemental)】None

【Prerequisite(s)】Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Computational Geotechnics

計算地盤工学

【Code】 10K016 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 English

【Instructor】 ,

【Course Description】 The course provides students with the numerical modeling of soils to predict the behavior such as consolidation and chemical transport in porous media. The course will cover reviews of the constitutive models of geomaterials, and the development of fully coupled finite element formulation for solid-fluid two phase materials. Students are required to develop a finite element code for solving boundary value problems. At the end of the term, students are required to give a presentation of the results.

【Grading】 Presentation and home works

【Course Goals】 Understanding the numerical modeling of soils to predict the mechanical behavior of porous media, such as, deformation of two-phase mixture and chemical transportation.

【Course Topics】

Theme	Class number of times	Description
Guidance and Introduction	1	Fundamental concept in continuum mechanics such as deformation, stresses, and motion.
Governing equations for fluid-solid two-phase materials	2	Motion, conservation of mass, balance of linear momentum for fluid-solid two-phase materials. Constitutive models for soils, including elasticity, plasticity, and visco-plasticity.
Ground water flow and chemical transport	5	Chemical transport in porous media, advective-dispersive chemical transport.
Boundary value problem, FEM programming	5	The virtual work theorem and finite element method for two phase material are described for quasi-static and dynamic problems within the framework of infinitesimal strain theory. Programming code for consolidation analysis is presented.
Presentation	2	Students are required to give a presentation of the results.

【Textbook】 Handout will be given.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental geomechanics and numerical methods

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Geo-Risk Management**

ジオリスクマネジメント

【Code】 10F238 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Ohtsu

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with geo-risk engineering, the topics of risk analysis focusing on geotechnical structures. In detail, the contents of lectures consist of following topics: Introduction to risk analysis, Mathematical background of geo-risk evaluation, Examples of risk evaluation mainly focusing on slopes and Risk management on road slopes.

【Grading】 Attendance(10%), Report(30%), Examination(60%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance Introduction of Geo-Asset Management
Basic	4	Basics of Risk Analysis (3)
Probability theory	7	Evaluation of Slope Risk
Case Studies in Asian Countries	2	Natural Disasters in Asian Countries
Feed back	1	Feed back

【Textbook】 Hiroyasu Ohtsu, Project Management, Corona Publishing, 2010. (in Japanese)

【Textbook(supplemental)】 C. Chapman and S. Ward, Project Risk Management, John Wiley &amp; Sons, 1997.

R. Flanagan and G. Norman, Risk Management and Construction, Blackwell Science

V.M. Malhotra &amp; N.J. Carino, CRC Handbook on Nondestructive Testing of Concrete, CRC Press, 1989.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

# Fundamental Geofront Engineering

## ジオフロント工学原論

【Code】 10F405 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st 【Location】 C1 Jin-Yu Hall  
 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Prof. Mamoru MIMURA, Prof. Makoto KIMURA, Assoc. Prof. Yosuke HIGO

【Course Description】 This course deals with near-surface quaternary soft soil deposits that are the most important in the engineering sense.

Physical properties and the mechanical characteristics of partially saturated and fully saturated soils are explained, and then various problems in terms of disaster prevention and infrastructure construction are discussed.

【Grading】 Performance grading will be provided based on quality of assigned reports and presentations, etc.

【Course Goals】 The aim of this course is to understand engineering problems and their mechanical background in the following points:

- Physical properties and mechanical characteristics of quaternary soft soil deposits and relevant engineering problems in terms of disaster prevention

- Fundamentals of unsaturated soil mechanics and engineering problems of earth structures in terms of disaster prevention

- Concepts of innovative underground foundations and structures and engineering problems during construction

### 【Course Topics】

Theme	Class number of times	Description
Outline of the course, introduction to quaternary deposits	1	Introduction to quaternary deposits. Types and mechanisms of geotechnical disasters relevant to quaternary deposits.
Geo-informatic database	1	Geo-informatic database and its application to modelling soft alluvial soils, liquefaction hazard map, etc.
Evaluation of subsurface structure based on GID	1	Scheme to evaluate subsurface structures using Geo-informatic database including boring logs, geophysical exploration, geological structures. Application to Kyoto basin is given.
Evaluation of liquefaction for near-surface sand deposits	1	Evaluation of liquefaction for near-surface sand deposits using Geo-informatic database is explained. Applications to the 1995 Hyogo-ken Nanbu Earthquake and the 2011 Off the Pacific Coast of Tohoku Earthquake are given, through which open questions are discussed.
Problems of soft clay deposits	1	Deformation characteristics and stability of soft clay deposits and their evaluation methods are explained, e.g., effectiveness and limitation of ground improvement, long term settlement problem, and case histories of large scale reclamation.
Concept of innovative underground structures	1	Citizen-participate-type renovation technique for unpaved roads using sandbags.
Concept of innovative underground structures	1	New construction method of embankments using consecutive precast arch culvert.
Concept of innovative underground structures	2	Technical problems of steel pipe sheet pile. Development of consecutive steel pipe sheet pile and its application.
Outline of earth structures, Unsaturated soil mechanics	2	Roles of earth structures as an infrastructure. Unsaturated soil mechanics.
Damage of earth structures caused by rainfall and earthquake	1	Case examples and their mechanisms of the damages of earth structures caused by rainfall and earthquake.
Methods to evaluate and improve stability of earth structures subjected to rainfall and earthquake	1	Design methods of earth structures and their problems are outlined.
Site visit	1	Visit construction site relevant to the issues of this course.
Evaluation and feedback	1	Evaluation of achievement by assigned reports and its feedback are given.

【Textbook】 Handout will be distributed.

【Textbook(supplemental)】 References are indicated in the handout.

【Prerequisite(s)】 Undergraduate courses in geology, geotechnical engineering, and soil mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Public Finance**

公共財政論

【Code】10F203 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Mon 3rd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Kobayashi, Matsushima,

【Course Description】The concept of public finance will be taught based upon the framework of Macro economics.

【Grading】Final Exam: 60-70%

Mid-term Exam and Attendance: 30-40%

【Course Goals】Understand the concept of public finance

## 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Explain the outline of this course
GDP and 2. Circular flow model of macro economics	2	Explain about the circular flow model of macro economics and the definition of GDP
Input Output Table and General Equilibrium Model	2	Explain about the input-output table and its role on general equilibrium model
IS-LM Model	2	Explain about IS-LM model to analyze both goods market and money market
International Economics	2	Explain about the international account balance and IS-LM model with trade
AD-AS Model	2	Explain about AD-AS model which analyze the mid term
Economic Growth Model	2	Explain about economic growth model in which long term economic growth is analyzed
Summary	1	Summarize classes and check whether students could achieved its goal.
feedback	1	Accept feedback from students

## 【Textbook】

【Textbook(supplemental)】Dornbusch et al., Macroeconomics 10th edition, Mcgrow-hill, 2008

【Prerequisite(s)】Basic Microeconomics

【Independent Study Outside of Class】

【Web Sites】will be notified in the first class.

【Additional Information】

# City Logistics

## シティロジスティクス

【Code】10F213 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】C1-172 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】English 【Instructor】Eiichi Taniguchi, Ali G. Qureshi

【Course Description】The methodologies of city logistics for establishing efficient and environmentally friendly logistics systems in urban areas will be described. Focusing on the truck traffic within road network, the process, models and the evaluation for building urban freight policy will be given. As well logistics systems using recent development of ICT, the effects of e-commerce on freight transport and supply chain management will be discussed.

【Grading】Term examination 80%, Report 10% and Quiz 10%

【Course Goals】The course goals are fully understanding the methodologies for establishing efficient, environmentally friendly and safe logistics systems in urban areas as well as obtaining the basic knowledge on modelling and evaluating city logistics initiatives.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to issues on urban freight transport is given and the importance of these issues is discussed in conjunction with urban planning.
What is city logistics?	1	City logistics are presented to totally solve problems on the efficiency of urban freight transport as well as social problems including traffic congestion, traffic environment, traffic safety and energy. The concepts of city logistics and characteristics and implementation methods are given.
Status quo and issues in freight transport--urban freight transport policy	1	The status quo and issues on freight transport is presented and urban freight transport policies are discussed for establishing efficient, environmentally friendly logistics systems in urban areas.
ITS and logistics	1	Logistics systems using ITS (Intelligent Transport Systems) are presented and how to implement city logistics initiatives using ITS is discussed.
Vehicle routing and scheduling	3	Models for optimising the visiting order and allocation of trucks in delivering goods to customers in urban areas are given and solution methodologies and practical applications are discussed. The probabilistic vehicle routing and scheduling problems with the uncertainty of travel times as well as the dynamic vehicle routing and scheduling problems with the real time travel times are also described.
Location of logistics terminals	2	The optimal location models of logistics terminals and the solution methodologies and their application to practical problems are presented. The location routing planning including vehicle routing and scheduling problems are discussed.
Cooperative freight transport systems	1	Cooperative freight transport systems which jointly operate logistics terminals, trucks and information systems are presented. The merits and demerits of cooperative freight transport systems as well as the methods for promoting them are discussed.
Application of ICT and ITS	1	It is shown that ICT (Information and Communication Technology) and ITS (Intelligent Transport Systems) allow us to collect data, transmit and analyse them relating to city logistics. The importance of ICT and ITS is emphasized.
Supply chain management, third party logistics and intermodal freight transport	1	Supply chain management, third party logistics and intermodal freight transport is presented and the innovative management systems which are used in modern logistics are discussed.
New freight transport systems	1	The categorization, characteristics and significance of new freight transport systems including underground freight transport systems are presented. The possibility of realizing new freight transport systems is discussed based on cost benefit analyses.
transport demand management and e-commerce	1	The transport demand management, which is important in city logistics is described and the difference is highlighted with the transport demand management for passenger traffic. Effects of e-commerce on urban freight transport are discussed based on recent behaviour change of consumers.
deregulation and evaluating city logistics	1	The deregulation on freight transport is described and performance indicators for evaluating city logistics initiatives are discussed.

【Textbook】1) Taniguchi, E. and T. Nemoto, City logistics--Efficient and environmentally friendly freight transport planning in urban areas, Morikita Publishing, 2001 (In Japanese).

2) Taniguchi, E., R.G. Thompson, T. Yamada and R. van Duin, City Logistics --- Network modelling and Intelligent Transport Systems. Pergamon, Oxford, 2001.

3) Taniguchi, E. and R.G. Thompson (Eds.) Innovations in freight transport, WIT Press, Southampton, 2002.

4) Taniguchi, E. (Eds.) Contemporary new city logistics, Morikita Publishing, 2005 (In Japanese).

5) Taniguchi, E., R.G. Thompson, City Logistics:Mapping the Future CRC Press, 2014.

6) Taniguchi, E., T.F. Fwa, R.G. Thompson, Urban Transportation and Logistics: Health, Safety, and Security Concerns, CRC Press, 2014.

【Textbook(supplemental)】1) Urban logistics planning, In: Urban transport II, Traffic Engineering Series, Japan Society of Traffic Engineers, 2002 (In Japanese).

2) Brewer, A. M., K.J. Button and D.A. Hensher (Eds.) Handbook of logistics and supply chain management, Pergamon, Oxford, 2001.

3) R.G. Kasilingam, Logistics and transportation, Kluwer Academic Publishers, Dordrecht, 1998.

4) OECD, Delivering the Goods---21st Century Challenges to Urban goods Transport, OECD, 2003.

5) Taniguchi, E. and R.G. Thompson (Eds.) Logistics systems for sustainable cities, Elsevier, 2004.

6) Taniguchi, E. and R.G. Thompson (Eds.) Recent advances in city logistics, Elsevier, 2006.

7) Kuse, H., K. Takada and Y. Takahashi, Logistics management in urban areas, Keiso Shobo, 2006.

8) Taniguchi, E. and R.G. Thompson (Eds.) Innovations in city logistics, Nova Science Publisher, 2008.

9) Golden, B., Raghavan, S. and Wasil, E. (Eds.) The vehicle routing problem: Latest advances and new challenges, Springer, 2008.

10) PIARC, Public sector governance on urban freight transport, 2012.

11) Tavasszy, L. and De Jong (Eds.), G. Modelling freight transport, Elsevier, 2014.

12) Ben-Akiva, M., Meersman, H. and Van de Voorde, E. Freight transport modelling, Emerald, 2014.

【Prerequisite(s)】Linear programming, optimisation, queueing theory

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Risk Management Theory

リスクマネジメント論

【Code】 10F223 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture and exercise 【Language】 English

【Instructor】 Muneta Yokomatsu,

【Course Description】 The aim of the class is to provide the basic knowledge of risk management methods for various types of risks such as natural disaster, environment and natural resources in urban and rural areas. Students will learn the decision making principle under risks in Economics and asset pricing methods in Financial Engineering as well as have exercises of application on public project problems.

【Grading】 20% of score is valued on attendance and discussion in classes, and 80% on reports.

【Course Goals】 It is targeted to understand 1) representative concepts of risk and risk management process, 2) expected utility theory and 3) foundation of Financial Engineering, and examine 4) public project problems by applying the above knowledge.

### 【Course Topics】

Theme	Class number of times	Description
Basic framework of risk management	2	1-1 Representative concept of risk 1-2 Risk management technologies
Decision making theory under risks	3	2-1 The Bayes' theorem 2-2 The Expected utility theory
Financial engineering	6	3-1 The Capital Asset Pricing Model 3-2 Option pricing theory 3-3 The arbitrage theorem 3-4 The Black-Scholes formula
Decision making methods for projects	3	4-1 The decision tree analysis 4-2 The real option approach
Comprehension check	1	5 Comprehension check

### 【Textbook】

【Textbook(supplemental)】 1.Ross, S.M.: An Elementary Introduction To Mathematical Finance, Cambridge University Press, 1999

2.Sullivan W.G.: Engineering Economy, Pearson, 2012

【Prerequisite(s)】 Fundamental understanding of probability

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Computational Mechanics and Simulation

計算力学及びシミュレーション

【Code】10K008 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Exercises 【Language】English

【Instructor】Ishida, Lin, Furukawa, Flores,

【Course Description】The process to obtain numerical solutions for various problems in computational mechanics.

Discretization and some solving technique for initial/boundary value problems is to be introduced by the FEM. Fundamental concept of boundary element method (BEM) and its applications in the engineering field will be introduced. Statistical mechanics, molecular dynamics, Monte Carlo method and Multiple scale model will be shortly introduced in order to understand the basic theory of molecular dynamics simulation. Their applications to engineering problems are to be also given by showing some up-to-date examples. Theory of the distinct element method (DEM) will be lectured, and its application in the engineering field will also be explained. Study of contaminant migration in subsurface via groundwater flow modelling coupled with advective-dispersive solute transport. The general groundwater flow and chemical transport in porous media are introduced, then the governing equations for advective-dispersive chemical transport, and the analytical solution of the governing equations are explained. This course will be given in English.

【Grading】Achievement is evaluated by submitted reports to each topic.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Finite difference method	3	Explicit-FDM is explained using an example of unsteady motion of a mass point based on Voigt model. In addition, the numerical simulation results are compared to their theoretical solutions and discussed.
Boundary element method and Molecular dynamics simulation	4	Fundamental concept of boundary element method (BEM) and its applications in the engineering field will be introduced. Monte Carlo method and Multiple scale model will be shortly introduced in order to understand the basic theory of molecular dynamics simulation. Their application to engineering problems are to be also given by showing some up-to-date examples.
Distinct element method and its application	4	Theory of the distinct element method (DEM) will be lectured in this item. The DEM is the numerical analysis method for discontinuum. The application of the DEM in the engineering field will also be explained.
Migration of Contaminants in Subsurface	3	Study of contaminant migration in subsurface via groundwater flow modelling coupled with advective-dispersive solute transport. In this section, we will first introduce the general groundwater flow and chemical transport in porous media, then we will learn about the governing equations for advective-dispersive chemical transport, and finally we will define the parameters and find the analytical solution of the governing equations. Some numerical results will be used as examples to understand the process.
Confirmation of the learning achievement degree	1	Confirmation of the learning achievement degree

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Environmental Risk Analysis

### 環境リスク学

【Code】10F439 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Yoneda, Takano, Matsuda, Shimada, Matsui,

【Course Description】Paying attention to the environment of children in particular, students themselves study, make presentation, and debate about the environmental risk. Students learn the background, the actual situation, and the theory for quantitative risk analysis through practice of investigation and discussion by themselves.

【Grading】Grading based on the participation and performance in presentation and discussion.

【Course Goals】To understand or master the necessity of environmental risk analysis, its practical examples, framework for solving problems concerning to risk evaluation, technical and basic knowledge for environmental risk analysis, and the way of thinking for risk analysis

#### 【Course Topics】

Theme	Class number of times	Description
Introduction		
Framework of risk analysis	2	Introduction of lecture and grading. Framework of risk analysis for children of WHO.
Children and health risk	1	1) Why children 2) Children are not little adults
Children and environmental change	1	3) The paediatric environmental and health history 4) Global change and children
Air pollution	1	5) Outdoor air pollution 6) Indoor air pollution
Lead and pesticide	1	7) Pesticides 8) Lead
Heavy metal	1	9) Mercury 10) Other heavy metals
Various risk	1	11) Noise 12) Water 13) Food safety
Chemicals	1	14) Children and chemicals 15) Persistent Organic Pollutants
Tobacco and natural toxin	1	16) Second-hand tobacco smoke 17) Mycotoxins, plants, fungi and derivates
Occupational risk and radiation	1	18) Injuries 19) Ionizing and non-ionizing radiations 20) Occupational risks
Respiratory diseases and cancer	1	21) Respiratory diseases 22) Childhood cancer
Innume disorders and neural system	1	23) Immune disorders 24) Neurobehavioral and neurodevelopmental disorders
Endocrine system and environmental monitoring	1	25) Endocrine disorders 26) Bio-monitoring and environmental monitoring
D evelopmental toxicity and indicators	1	27) Early developmental and environmental origins of disease 28) Indicators

【Textbook】Necessary files are supplied.

【Textbook(supplemental)】To be introduced if necessary.

【Prerequisite(s)】Not necessary in particular.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】The contents may be changed according to the progress of lecture.

**Water Quality Engineering**

水環境工学

【Code】10F441 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 2nd

【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroaki TANAKA,Fumitake NISHIMURA,Naoyuki YAMASHITA,Makoto YASOJIMA,Sei-ichiro OKAMOTO

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	5	
	5	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Water Sanitary Engineering

水質衛生工学

【Code】 10F234 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English/Japanese 【Instructor】 Sadahiko Itoh, Shinya Echigo,

【Course Description】 The ultimate goal of this course is to understand "Sanitary Engineering" quantitatively. Students will learn methods to quantify chemical and microbial risk in drinking water and realize concept and methods of risk management and control.

【Grading】 Evaluated by assignments.

【Course Goals】 To quantify chemical and microbial risk in drinking water and to realize methodologies of risk management and control.

【Course Topics】

Theme	Class number of times	Description
Environmental risk and quantification	1	Introduction and goal of the class. Concept of "Sanitation". Environmental risk and quantification. Safety of drinking water and acceptable risk level.
Risk assessment and control of hazardous chemicals	3	Risk assessment of hazardous chemicals. Drinking water quality standards. Derivation of drinking water quality standards. The benchmark dose method.
Quantitative microbial risk assessment and management	5	Coexistence and competition between human and microbes. Quantitative microbial risk assessment (QMRA). Comparison of the risk assessment and management methods between chemicals and microbes. Disability adjusted life years (DALYs).
Perspectives of water treatment technology	5	Development of advanced water treatment processes. Water supply technology and its prospects. Water reuse and health risk. Access to safe drinking water in developing countries and global burden of disease.
Feedback and summary	1	Feedback of assignments and summary.

【Textbook】 Class handouts

【Textbook(supplemental)】 Itoh, S., Echigo, S.: Disinfection By-products in Water, GIHOUDOU SHUPPAN Co., Ltd., 2008 (in Japanese).

【Prerequisite(s)】 General understanding of water quality and water treatment process

【Independent Study Outside of Class】

【Web Sites】 Data for assignments will be at <http://www.urban.env.kyoto-u.ac.jp>

【Additional Information】

## Systems Approach on Sound Material Cycles Society

### 循環型社会システム論

【Code】10F454 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd 【Location】C1-192

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Shinichi Sakai, Yasuhiro Hirai,

【Course Description】It has become a major political/ social issue to establish a Sound Material-Cycle Society in order to save the earth resources and energy and to preserve environmental conservation. This course mainly covers the following topics: 1) History, current status, and future prospect of waste issues and establishment of a sound material-cycles society. 2) Basic concepts and current conditions/ challenges of the following items: The Basic Law for Establishing the Material Cycles Society and the Basic Plan for accomplishing it; Containers and Packaging Recycling Law; Home Appliance Recycling Law; End-of-Life Vehicle Recycling Law and others. 3) Basic concept and application of material flow analysis and life cycle assessment; these tools are important to grasp the whole flow of each recycling, resource use, product consumption, recycle and disposal of waste electrical and electronic equipment, for which it is required to take Clean Cycle & Control concepts in relation to chemical substances. Along with above topics, source origin, behavior, and decomposition of persistent organic pollutants, which should be inevitably linked to the realization of a Sound Material-Cycle Society, will also be discussed in the class.

【Grading】Evaluation will be done based on the test scores and learning attitude in class.

【Course Goals】The goal of this class is to help students understand the systems and technologies for establishing a Sound Material Cycles Society; students learn how to think about material flow analysis and life cycle assessment in order to develop deep understanding of the whole system of material flow (i.e., resource use, product consumption, cycles and disposal of waste).

#### 【Course Topics】

Theme	Class number of times	Description
The Basic Law for Establishing the Material Cycles Society and the Basic Plan for Material Cycles	1	Learn the frame work and three indices of this basic plan in detail, and examine recent globally developed “3R Initiative” activities and status of material cycles in Asian countries.
Development of Each Recycling System	3	Learn the following items separately designated as effective measures under The Basic Law for Establishing the Material Cycles Society: 1) Containers and packaging 2) Home Appliance 3) End-of-Life Vehicle 4) Construction Material 5) Food Material
Each Recycling System and Clean, Cycles & Control Concepts	3	Examine application of the following strategic concepts for waste electrical and electronic equipment, end-of-life vehicles, and battery waste. 1) Clean: Avoid the use of hazardous waste and chemical substances. 2) Cycle: Apply cycle concept when use effects are expected but no alternatives are available.
Basic concept and application of material flow and life cycle analyses	5	Learn about basic concept of Material Flow Analysis (MFA) and Life Cycle Assessment (LCA). Examine food waste recycling using these analyses as a case study.
Environmental Transport Model and Behavior of Persistent Organic Pollutants (POPs)	2	Learn basic concept and application of the model. Examine case studies of global mobility of POPs and behavior of PCB on regional and global scales.
Confirmation of Attainment	1	Confirm students’ levels of understanding on the course topics, and make sure of the points of MFA, LCA, and systems and techniques for establishing a sound material-cycle society.

【Textbook】Not specified. Materials and references will be distributed when needed.

【Textbook(supplemental)】Introduced in class when necessary.

【Prerequisite(s)】Solid Waste Management

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Atmospheric and Global Environmental Engineering, Adv.**

大気・地球環境工学特論

【Code】 10F446 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese/English

【Instructor】 Yuzuru MATSUOKA, Gakuji KURATA,

【Course Description】 The contents of the lecture are as follows. (1) History of Global Warming problem, Radiative forcing, Green house gas emission, Carbon cycle, Mechanism of Climate Change, Mitigation measures, Social and Natural impact of Climate change (2) Mechanism of formation of Photochemical oxidant and Acid rain, Global scale transportation of atmospheric pollutants, Deposition and its impact of air pollutants, control measure of air pollution.

【Grading】 A quiz is carried out at the beginning of every lectures.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance, IPCC, Observation of a climate change	1 (Matsuoka)	
Radiative forcing	1 (Matsuoka)	
Greenhouse gas	1 (Matsuoka)	
Carbon cycle and response of climate	1 (Matsuoka)	
Impact of Climate Change	1 (Matsuoka)	
Energy system and mitigation of climate change	1 (Matsuoka)	
Cross-border transportation and the international measure against air pollution	1 (Kurata)	
Urban Air pollution	1 (Kurata)	
Acid Deposition and its impact	1 (Kurata)	
Simulation of advection and diffusion	1 (Kurata)	
Simulation of Atmospheric Chemistry	1 (Kurata)	
Indoor air pollution and health impact	1 (Kurata)	
Practice	2 (Kurata and Matsuoka)	
Achievement test	1	

【Textbook】 Handout

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Urban Metabolism Engineering**

都市代謝工学

【Code】 10A632 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 3rd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English / Japanese 【Instructor】 Masaki Takaoka, Gakuji Kurata, Kazuyuki Oshita,

【Course Description】 Much energy and resources are consumed to maintain various activities in urban city. As the result, various environmental loads such as exhaust gas, wastewater and waste generate and should be reduced to levels natural environment can accept. To establish sustainable urban metabolism, concept, elements, control, optimization and management of urban metabolism are explained.

【Grading】 Small tests and reports are evaluated.

【Course Goals】 To understand technological measures by learning about current trend and issue of urban metabolism and related engineering principles.

## 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Concept of urban metabolism and its system are explained
Elements of urban metabolic system	7	Planning and selection of urban metabolic system, Transportation & collection, Engineering principles on Recycling, Thermal recovery, Engineering principles on flue gas treatment and Landfill management are explained.
Control, optimization and management of urban metabolic system and environmental equipment	4	Fundamentals of control theory, optimization, system identification and simulation of urban metabolic system and environmental equipment
Design of sewage treatment system in urban area	2	Properties and chemical compositions of sewage and sludge. Introduction and developing trend of sewage treatment system. Elemental and heat balance analysis of sedimentation, aeration tank, anaerobic fermentation and incineration.
Feedback and summary	1	Feedback of small tests and summary

【Textbook】 Recent paper and/or books will be used.

【Textbook(supplemental)】

【Prerequisite(s)】 Environmental plant engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## New Environmental Engineering I, Advanced

### 新環境工学特論 I

【Code】 10F456 【Course Year】 2013 【Term】 1st term 【Class day & Period】 Mon 5th

【Location】 Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 Y. Shimizu (Prof), H. Tanaka (Prof), and S. Fujii (Prof),

【Course Description】 This course provides various kinds of engineering issues related to the water environment in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students.

The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University of China. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system).

【Grading】 Evaluated by class attendance, Q&A and presentation.

【Course Goals】 Each student is requested to give a short presentation in English in the end of the course. The students will understand the present circumstance of environments in the world, and the students may improve their English skill and international senses through these lectures, presentations, and discussions.

#### 【Course Topics】

Theme	Class number of times	Description
Wastewater Treatment in Japan	1.4	Guidance & self introduction of students & lecturer on “ Wastewater Treatment Plants Case Study in Japan (Fujii)
Ecological Sanitation	1.4	From Ecotoilets to Ecotowns ( Shimizu)
Wastewater Reuse	1.4	Wastewater Reuse & Disinfection (Tanaka)
Membrane Treatment	1.3	Treatment Technologies (Practical & Advanced Technology I): Membrane Technology (MT) (Prof. Huang, Tsinghua University)
POPs	1.4	Global POPs (Persistent Organic Pollutants) Pollution, and Countermeasures (Fujii)
Wastewater Treatment in Malaysia	1.3	Wastewater Treatment Plants Case Study in Malaysia - Design Consideration - (Prof. Ghazaly, University of Malaya)
Anaerobic Treatment	1.3	Anaerobic Biological Treatment Technologies (Prof. Shaliza, University of Malaya)
Wastewater Treatment in China	1.3	Wastewater Treatment Plant: Case Study in China, Biological Nutrient Removal (Prof. Wen, Tsinghua University)
Water Pollution in Malaysia	1.4	History of Water Pollution in Malaysia (Prof. Ghufuran, University of Malaya)
Student Presentation	1.4	Student Presentations /Discussions I (all)
Student Presentation	1.4	Student Presentations /Discussions II (all)

【Textbook】 Class handouts

【Textbook(supplemental)】 Introduced in the classes

【Prerequisite(s)】 General understanding of water environmental issues

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Either of this course or “ New Environmental Engineering II, advanced ” can be dealt as “ Asian Environmental Engineering ” . PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

## New Environmental Engineering II, Advanced

### 新環境工学特論 II

【Code】10F458 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 5th

【Location】Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】English 【Instructor】Prof. Matsuoka, Prof. Shimidzu, Prof. Takaoka, Associate Prof. Kurata, Prof. Fujii,

【Course Description】This course provides various kinds of engineering issues related to atmospheric environment and solid wastes management in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students. The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system). The students are requested to give a short presentation in English in the end of the lecture course. This course may improve students' English skill and international senses through these lectures, presentations, and discussions.

【Grading】Evaluate by class attendance, Q&A and presentation.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Global warming and Low carbon society	1.4	Global warming and Low carbon society (Matsuoka)
Atmospheric diffusion and modeling	1.4	Atmospheric diffusion and modeling (Prof. S Wang, Tsinghua University)
Air Pollution, Its Historical Perspective from Asian Countries (I),China	1.4	Air Pollution, Its Historical Perspective from Asian Countries (I),China (Prof. Hao, Tsinghua University)
Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia	1.4	Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia (Prof. Nik, University of Malaya)
Air Pollution, Its Historical Perspective from Asian Countries (III), Japan	1.4	Air Pollution, Its Historical Perspective from Asian Countries (III), Japan (Kurata)
Student Presentations /Discussions I	1.4	Student Presentations /Discussions I (all)
Introduction to Municipal Solid Waste (MSW) Management in Malaysia	1.4	Introduction to Municipal Solid Waste (MSW) Management in Malaysia (Prof. Agamuthu, University of Malaya)
Solid Waste Management, Case Study in China	1.4	Solid Waste Management, Case Study in China (Prof. Wang, Tsinghua University)
Solid Waste Management, Case Study in Japan	1.4	Solid Waste Management, Case Study in Japan (Takaoka )
Solid Waste Management, Case Study in Malaysia	1.4	Solid Waste Management, Case Study in Malaysia (Prof. Agamuthu, University of Malaya)
Student Presentations /Discussions II	1	Student Presentations /Discussions II (all)

【Textbook】Class handouts

【Textbook(supplemental)】Introduce in the lecture classes

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Either of this course or “ New Environmental Engineering I, advanced ” can be dealt as “ Asian Environmental Enigneering ”. PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

**Advanced Environmental Engineering Lab.**

環境工学先端実験演習

【Code】 10F470 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day &amp; Period】 Monday 3,4 【Location】 C1-173 【Credits】 2 【Restriction】 less than 10 students

【Lecture Form(s)】 Seminar and Exercise 【Language】 English / Japanese

【Instructor】 Sadahiko Itoh, Minoru Yoneda, Masaki Takaoka, Shinya Echigo, Gakuji Kurata, Makoto Yasojima,

【Course Description】 Analytical methods to characterize environmental samples are learnt through practical training including site visit to other research institute or analytical company. Also, integration of environmental information using GIS is also mastered.

【Grading】 Attendance at the class and report subjects are evaluated.

【Course Goals】 To promote your own research by learning each research method with wide vision

## 【Course Topics】

Theme	Class number of times	Description
Guidance and Safety Education	1	The content of subject and safety education for the following experiment are explained.
Quantitative analysis of elements	3	The principle of multielement analysis is explained and practical training of ICP-AES or ICP-MS machine is conducted.
Qualitative analysis of elements	2	The principle of X-ray based methods is explained and practical training of one or two X-ray based machine is conducted.
Qualitative analysis of organic compounds and bioassay	5	Qualitative analysis of organic compounds such as mass spectrometry, NMR, ESR and IR and bioassay are explained and practical training of GC-MS etc. is conducted.
GIS	3	The way to use GIS is learnt.
Site visit	1	Site visit to research institute or analytical company

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Global Survivability Studies**

グローバル生存学

【Code】 10F113 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Introduction to Advanced Material Science and Technology ( English lecture )

## 先端マテリアルサイエンス通論 ( 英語科目 )

【Code】10K001 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Fri 4th 【Location】KatsuraA2-308,Yoshida Research Bldg.No4,-Room3(Distance lectures)

【Credits】First term: 2, Spring term: 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】GL Edu. Center, J. Assoc. Prof., Tadao Mizuno  
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called "high technologies", and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 先端マテリアル講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Stress-Diffusion Coupling in Polymer Gels	1	Because a polymer gel in solvent forms a thermodynamic semi-open system, a mechanical stimulus imposed on the gel induces a thermodynamic response. The outline of this phenomenon is explained by using several examples. (4/10 T. Takigawa)
Modern Organic Synthesis for Material Science	1	The lecture will deliver recent developments in organic synthesis, particularly focusing on catalytic reactions that have revolutionized chemical processes, and their applications in the production of some important pharmaceuticals and organic materials. (4/17 Y. Nakao)
Oxide Magnetic Materials	1	Fundamentals of magnetism and magnetic properties of oxides as well as applications of magnetic oxide materials are described. A brief introduction to recent magnetics-related technologies such as spintronics is also given. (4/24 K. Tanaka)
In Vivo Optical and Photoacoustic Tumor Imaging using Near-infrared Dye-conjugated Amphiphilic Polymers	1	Optical and photoacoustic imaging methods are one of the most powerful and noninvasive techniques with which to visualize organs as well as tumor tissues. In this lecture, students can learn the basic principles of molecular imaging as well as recent progress in this field. (5/8 K. Ohe)
Photofunctional Nanocarbon Materials	1	Photo-functionalization of nanocarbon materials, e.g., fullerenes, carbon nanotubes, and graphenes, using the methodologies of organic synthetic chemistry and their application in photoelectrochemical devices. (5/15 T. Umeyama)
Rheology Control by Associating Polymers	1	Hydrophobically modified water-soluble polymers (associating polymers) have been used as rheology modifiers or thickeners because rheological properties of solutions and dispersions are drastically changed by the addition of small amounts of associating polymers. In this lecture, recent development on the molecular origin of the structure formation and rheological properties of associating polymers will be reviewed. (5/22 T. Koga)
Solar Hydrogen Production using Semiconductor Photocatalyst	1	The development of a clean and renewable energy carrier that does not utilize fossil fuels is a great technological challenge. Photocatalytic water splitting using semiconductor materials has attracted considerable interest due to its potential to cleanly produce H <sub>2</sub> from water by utilizing abundant solar light. In the present lecture, the basis and the recent progress in photocatalytic water splitting will be introduced. (5/29 R. Abe)
Hyperthermophiles and their thermostable biomolecules	1	This lecture will first introduce the diversity and classification of life. It will then focus on hyperthermophiles and their thermostable molecules, such as proteins, nucleic acids and lipids. (6/5 H. Atomi)
Physical Organic Chemistry of Supramolecular Photofunctional Organic Materials	1	This lecture explains interesting behaviors of photofunctional organic materials, such as photochromic compounds and fluorescence dyes, in the aggregated and self-organized state from the viewpoint of physical organic chemistry. (6/12 K. Matsuda)
Production of Advanced Materials by Micro Chemical Plants	1	This lecture will concentrate on the following topics related to the micro chemical processes. 1) Feature of micro devices, 2) Possibility of using micro systems for real production, 3) Design problems of micro chemical plants, 4) Control of micro chemical plants, 5) Blockage detection of parallelized micro plants, 6) Future direction of the research on micro chemical plants. (6/19 S. Hasebe)
Directed Self-Assembly (DSA) of Block Copolymers	1	Recently, Directed Self-Assembly (DSA) technology of block copolymers has received a lot of attention in the field of semiconductor research. In this lecture, the fundamentals of microphase separation of block copolymers and the application of DSA to lithographic technologies will be reviewed. (6/26 T. Koga)
High-temperature superconductor as a playground for the macroscopic quantum phenomena	1	High temperature superconductors have attracted much attention to their emerging mechanism and applications. They are also quite peculiar for playgrounds for superconducting properties as macroscopic quantum phenomena. In this lecture, quantum phenomena found in high temperature superconductors and their applications are discussed. (7/3 I. Kakeya)
Introduction to Nuclear Materials	1	Nuclear materials are designed for good performance in irradiation field of neutron and high-energy particles. Fundamentals and some examples of nuclear reactions with these particles will be talked. (7/10 I. Takagi)
Materials Processing using external fields for microstructure control	1	Properties of materials are not simply determined by atomic structure and chemical composition. Microstructure (crystal grain size, crystallographic orientation and so on) significantly influences the properties. Not a few techniques have been developed for controlling the microstructure. Materials processing using external fields will be demonstrated in this class. (7/17 H. Yasuda)
Electrodeposition and Electroless Deposition for Materials Processing	1	(1) Fundamentals chemistry, electrochemistry, and thermodynamics, and (2) applications of electrodeposition and electroless deposition for materials processing. (7/24 K. Murase)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Check the notice on the bulletin board.

Students who take Spring term (Lecture code 10H012) should attend first 11 lectures.

# Advanced Modern Science and Technology ( English lecture )

## 現代科学技術特論 ( 英語科目 )

【Code】10K005 【Course Year】 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system), 1.5(Modified quarter system) 【Restriction】No Restriction

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】Please go to KULASIS Web site. You can find an attachment file, " 通知版 : 2015 現代科学技術特論講義概要 ", where the term Credit will tell you the requirement.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Oct. 1 Kiyoshi Takeyama	1	"New Type of Public Space in Contemporary Urban Context" Various form of urban fabrics and developments requires new type of public spaces. We will discuss the possibility of places by providing architecture and urban context with flow of convergence and divergence where people get opportunities to meet and gather.
Oct. 8 Minoru Yoneda	1	"Countermeasures of the contaminated water at Fukushima Daiichi Nuclear Power Station and that of the contaminated soil in Fukushima area" The situation of contaminated water in Fukushima Daiichi Nuclear Power Station and soil contamination in and around Fukushima area and their technological countermeasures taken today will be introduced and discussed.
Oct. 22 Minoru Miyahara	1	"Engineering Approach to Phase Behavior of Fluids Confined in Nanospace" Fluids confined in nano-scale pores exhibit peculiar phase behaviors that depends strongly on physico-chemical effects by pore walls and conditions of the bulk phase in equilibrium with the pore fluids, to which the engineering approach must be effective.
Oct. 29 Minoru Miyahara	1	"Elucidation of Principles for the Self-Organization of Mesoscale Colloidal Particles" The process of so-called the colloid crystal has been pursued to find out the key principles for the structure evolution, employing the Brownian dynamics simulations. Also given in the lecture will be various pattern formations in the convective self-assembly of colloidal suspensions.
Nov. 5 Tohru Sato	1	"Theoretical design for light-emitting molecules from the view of electron-vibration interactions" This lecture describes theoretical design principles for highly efficient emitting molecules in organic light-emitting diodes (OLED) from the view of electron-vibration interactions (vibronic couplings).
Nov. 12 Hirofumi Yamada	1	"Exploration into nanometer-scale world - frontiers of scanning probe microscopy -" Recent, various advanced research fields, such as developments of novel semiconducting devices, single-molecule chemistry and studies on biomolecule functions, require nanometer-scale measurements for visualizing and/or controlling their fundamental processes. Scanning probe microscopy (SPM) is one of the most powerful techniques for such measurements. In this lecture basics of SPM are first explained and then a wide variety of state-of-the-art SPM measurement techniques are presented.
Nov. 19 Haruyuki Atomi	1	"Genome sequences, what do they say and how can we use them?" Owing to the revolutionary advances in DNA sequencing technology, the complete genome sequences of a large number of organisms are now available. Here we will discuss what these genome sequences tell us and how we can use them to further increase our understanding of life.
Nov. 26 Satoru Komori	1	"Turbulent Transport across the Air-Water Interface at High Wind Speeds and Forecasting of Typhoon Intensity" Laboratory measurements of turbulent momentum, heat and mass fluxes across sheared wavy interfaces at high wind speeds will be introduced, and then typhoon and hurricane intensities will be forecasted by applying the measurements to a numerical model. After this lecture, laboratory experiments will be demonstrated.
Dec. 3 Koji Otsuka	1	"Micro- and Nano-scale Separations in Analytical Chemistry" Micro- and nano-scale high performance separation techniques, including capillary electrophoresis and microchip electrophoresis, will be discussed in terms of both fundamental characteristics and applications.
Dec. 10 Shiro Biwa	1	"Characterization of Advanced Composite Materials by Ultrasonic Waves" Introduction of advanced composite materials in transportation vehicle structures plays an important role in the reduction of energy consumption. In this lecture, the characterization of composite materials using ultrasonic waves will be discussed.
Dec. 17 Jiro Matsuo	1	"Modern techniques for material characterization" Overview of modern techniques for material characterization is given with basic principles and practical applications. Impacts on the life of the people of characterization techniques are also included.
Dec. 24 Yoshiharu Omura	1	"Exploration of Radiation Belts by Space Radio Engineering" Radiation belts of energetic particles are formed around magnetized planets such as the Earth, and they have been studied extensively by spacecraft missions and computer simulations for better understanding and utilization of the space plasma environment. We review historical development of space radio engineering and current understanding of radiation belt dynamics.
Jan. 7 Kazuo Aoki	1	"Global behavior of gases in view of molecular motion" It is important to understand flows and heat transfer in gases under extreme conditions when energy and environmental problems are discussed. The macroscopic behavior of the gas, in particular, that in low-pressure circumstances or in microscopic systems, are discussed on the basis of motion of gas molecules.
Jan. 21 Mitsuo Sawamoto	1	"Polymer Synthesis beyond the 21st Century: Precision Polymerizations and Novel Polymeric Materials" We are now in the "Polymer Age", where synthetic polymer materials are indispensable in the modern human life: healthy, safe, comfortable, and sustainable. A critical challenge herein is to develop "precision polymerization", polymer-forming reactions that provide polymers of well-defined structures and designed functions. Given these backgrounds, this lecture will overview the following subjects: (a) What polymers are; (b) How to synthesize polymers; (c) How and where polymeric materials work and function; (d) Precision polymer synthesis; and (e) The future of polymeric materials.
Jan. 28 Tetsuo Sakka	1	"Laser-induced breakdown spectroscopy and its application to underwater in-situ elemental analysis" Application of laser-induced breakdown spectroscopy (LIBS) to resource exploration at sea bottom is explained, and the importance of interdisciplinary research will be discussed.

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Location (Lecture room) has been changed. Please see the "Location".

Check the notice on the bulletin board.

Students who take Autumn term (Lecture code 10H006) should attend the first 11 lectures.

## Design Methodology

デザイン方法論

【Code】 10X401 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 4th

【Location】 C3-Lecture Room 4a 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,,

【Course Description】 In the 21st century, it is required to reconsider what is a design and what is a design method. The era a simple artifact is requested is over, and we have to create environmental and social systems including various relations such as the relation among artifacts, the relation between artifacts and men & environment, and the relation among human beings. The role of design is to develop “ Human Centered Design (HCD) ” which creates meaningful experiences through system integration of man-environmental systems. In this lecture, we explore the design methodology as a basic theory of design after 1960 ' s, explaining design problems, design process, design method, design thinking, and design science based on the design studies in various design fields such as craft, product, architecture, city, landscape, environment, community, education, society, mobility, business, and information. Especially to investigate the mechanism of creative design thinking is very important to solve the daily life problems and many difficult problems human kind encounters. Therefore we explain the design semiotics to clarify the mechanism of generating creative designs and to show valuable examples.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	2	
	2	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Theory for Designing Artifacts

アーティファクトデザイン論

【Code】 10X402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 5th

【Location】 C3-Lecture Room 4a 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 ,

【Course Description】 The activity of design is fundamentally similar across a wide variety of domains. I use artifact in a broad and atypical sense to describe any product of intentional creation, including physical goods, services, information systems, buildings, landscapes, organizations, and societies. The central theme of this lecture is that a unifying framework informs the human activity of design across all domains. For this purpose, the following steps of the design process are described: Sense gap, Define problem, Explore alternatives, and Select plan according to the Ulrich ' s classification. The principles and methodologies for each of those steps are provided in the lecture. Moreover, understanding user needs is a key element of problem definition, and that understanding is usually best developed with interactive and immersive methods. In this lecture, a variety of methodologies for participatory systems approach and an idea of user-experience are provided, and its contributions to the design process are discussed.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## インフォメーションデザイン論

【Code】 698541 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 5th

【Location】 C3-Lecture Room 4a 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】 Any valuable information or knowledge does not make sense if it is not transferred effectively among human beings and our society. We need to organize, design and present information in a way that fosters efficient and effective understanding of it. This course lectures information design, interaction design and visual design. Main topics of the course are: information design and information comprehension (sense-making) theory, information credibility, information organization, spatial cognition/cognitive maps/way finding, linguistics and information design, designing user interface & interactions, photo grammar & film grammar, story-telling, and information visualization.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	3	
	3	
	3	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Organization and Community Design

組織・コミュニティデザイン論

【Code】 10X403 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 C3-Lecture Room 4a 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】 Design of social organizations and communities is a critical component of any design. As we design any artifact--material or otherwise, we need to understand how people understand and act upon the artifacts. Social organizations and communities are then understood and redesigned. For this redesign, designers need to participate in the social organization or the community so that the design they produce is part of the organization or community. In this course, students will learn the basic ideas of organizational and community design and then experience the practices in the field. To do some work in the field, many sessions will be held over the weekend. Any students who seek to learn design are encouraged to take this course to acquire the basic literacy for design of any kind.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## フィールド分析法

【Code】 698542 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】 As a methodology of field analysis required to make product designs of products, services and business in the real field, we give some lectures and related exercise which include field research methods (ethnography, surveys method), quantitative analysis methods (various statistical analysis methods) and model building and simulation methods. After learning of the target field selection, setting of the investigation, and determination of the contents of the survey, you carry out the field research work using ethnography, survey methods and so on. At the next step, you learn data analysis methods using field data obtained from the field works. Finally, we hold the design workshop using the results of the actual field works which are obtained from construction of field analysis model, system dynamics, multi-agents simulation and so forth.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	4	
	3	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## デザイン構成論

【Code】 698543 【Course Year】 【Term】 1st term 【Class day & Period】 Mon 4th 【Location】 【Credits】 2

【Restriction】 【Lecture Form(s)】 Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design of Complex Mechanical Systems**

複雑系機械システムのデザイン

【Code】 10X411 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Fri 4th

【Location】 C3-Lecture Room 5 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Dynamic Systems Control Theory**

動的システム制御論

【Code】 10G013 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Tue 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design and Manufacturing Engineering**

設計生産論

【Code】10G011 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Fri 2nd

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Robotics**

ロボティクス

【Code】 10B407 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Fumitoshi Matsuno,

【Course Description】 Understanding of intelligent behaviors of living things is very interesting. And realization of their intelligent motion by a robot is also attractive for mechanical engineering. In this lecture, we consider basic understanding of beautiful human skill “ manipulation ” on the point of view of dynamics and control. First modeling methodologies for a rigid multibody system and a general dynamic model of a manipulator are provided. Next, a typical nonlinear control law is introduced and some problems for applying the controller are shown. Based on nature of the dynamics of the manipulator, a very simple and robust controller can be derived by designing energy of the system. This lecture provides modeling methodologies and controller design strategies of the rigid multibody system and we analyze a beautiful human skill of the manipulation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	3	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Theory for Design Systems Engineering

デザインシステム学

【Code】 10Q807 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tetsuo Sawaragi and Hiroaki Nakanishi,

【Course Description】 The lecture focuses on the human design activity; designing artifacts (things, events and systems) based on human intuitions, and designing human-machine systems in which the relations between human and objects are of importance.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	3	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Engineering Ethics and Management of Technology

技術者倫理と技術経営

【Code】10G057 【Course Year】Master 1st 【Term】1st term 【Class day & Period】Thu 3rd

【Location】Butsurikei-Kousya 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and Exercise

【Language】Japanese 【Instructor】Sawaragi, Nishiwaki, Tomita, M. Komori, Tsuchiya, Noda, Sato, Iseda,

【Course Description】Basic knowledge of Engineering Ethics and Management of Technology needed for future project leaders in companies and society is taught. Students have to make group work after-class hours as well as presentations of wrapping-up the discussions. Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. Management of Technology is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course consists of lectures, exercises, discussions and oral presentations under supervision of professional faculties and extramural lecturers.

【Grading】Submission of reports and presentations

【Course Goals】To cultivate a spirit of self-sufficiency needed for engineers

【Course Topics】

Theme	Class number of times	Description
Engineering Ethics	9	1. Introduction to Engineering Ethics (EE) 2. Medical Engineering Ethics 3. EE by Institution of Professional Engineers, Japan and abroad 4. Product Safety and Product Liability 5. Comprehensive Manufacturing and EE (1) 6. Comprehensive Manufacturing and EE (2) 7. Group Discussions 8. History and Philosophy of EE 9. Presentation on exercise of EE
Management of Technology	5	1. Product Portfolio, Strategy for Competition 2. Business Domain and MOT for Marketing 3. Organizational Strategy for Corporates' R & D 4. Management Theory for R & D 5. Presentation on exercise of MOT
Summary	1	

【Textbook】No textbook

【Textbook(supplemental)】Nothing

【Prerequisite(s)】Nothing particular

【Independent Study Outside of Class】

【Web Sites】No Web Site

【Additional Information】Nothing particular

# Optimum System Design Engineering

最適システム設計論

【Code】 10G403 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	5	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Applied Numerical Methods

応用数値計算法

【Code】 10G001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiyuki Tsuchiya,

【Course Description】 Numerical techniques, such as the finite element method and numerical control method, are indispensable in mechanical engineering. In this lecture, basics of numerical techniques which are required to study advanced methods for graduated students will be explained. The lecture will cover the error evaluation, linear system solution ( $Ax=b$ ), eigenvalue analysis, interpolation approximation method, solutions of ordinary differential equation and partial differential equation. The programing exercise is included in this lecture.

【Grading】 Home works (assigned about three times) and examination.

【Course Goals】 Understandings of mathematical theories and programing implementations of the numerical methods.

### 【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of this class
		Numerical representations and errors
		Macro programing using spread sheet applications
Numerical Error, Approximation	1	Matrix
		Norms
		Singular value decomposition
Linear simultaneous equation 1	2	Solution of simultaneous linear equations direct method, iteration method
Eigenvalue analysis	2	Eigenvalue problems
Interpolation	1.5	Interpolation and its errors
Numerical integra 1	1.5	Numerical integration methods
Normal differential equation and numerical integral	2	explicit method, implicit method initial value problem, boundary value problem
Partial differential equation	3	Differential expression of partial differential Diffusion equation, wave equation Poisson equation, Laplace equation
Examination	1	Feedback for homework and examination

【Textbook】 Lecture note will be given.

【Textbook(supplemental)】 Golub, G. H. and Loan, C. F. V., Matrix Computations, John Hopkins University Press  
R.D.Richtmyer and K.W.Morton, Difference Methods for Initial-Value Problems, Second Edition, John Wiley & Sons 1967

【Prerequisite(s)】 Basic mathematics for undergraduates

Basic macro programing

【Independent Study Outside of Class】 Problems are based on macro on Microsoft Excel or OpenOffice (LibreOffice).

【Web Sites】 Panda: <https://panda.ecs.kyoto-u.ac.jp>

【Additional Information】 Have a PC with Microsoft Excel with VBA or Apache OpenOffice(<http://www.openoffice.org/ja/>), LibreOffice (<https://ja.libreoffice.org/>).

## Advanced Flight Dynamics of Aerospace Vehicle

航空宇宙機力学特論

【Code】10C430 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kei Senda,

【Course Description】Flight Dynamics and Control of Aerospace Vehicles including Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

【Grading】Evaluation depends on marks of examination and exercises.

【Course Goals】To understand analytical mechanics through flight dynamics of aerospace vehicles: Basic items of Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

### 【Course Topics】

Theme	Class number of times	Description
Analytical Mechanics	7	1. Newton equations, 2. Lagrange equations, 3. Hamilton equations
Orbital Mechanics	4	1. Motions in central force field, 2. Conservation law, 3. Orbit transition
Attitude Dynamics and Control	4	1. Kinematics of rotation, 2. Attitude mechanics, 3. Stability analysis of equilibrium points, 4. Attitude Control

### 【Textbook】

【Textbook(supplemental)】L. D. Landau and E. M. Lifshitz: Mechanics, Volume 1 (Course of Theoretical Physics

Herbert Goldstein: Classical Mechanics

Toda and Nakajima: Introductory course of physics #1, #2, #10, etc. (Iwnami Shoten)

【Prerequisite(s)】Foundation of mechanics and mathematics, Flight Dynamics of Aerospace Vehicle (Undergraduate)

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

**Introduction to the Design and Implementation of Micro-Systems**

微小電気機械創製学

【Code】 10V202 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Mechanical Functional Device Engineering**

メカ機能デバイス工学

【Code】 10G025 【Course Year】 Master 1st 【Term】 2nd term 【Class day &amp; Period】 Wed 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	1	
	1	
	1	
	1	
	1	
	1	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Mechanical Engineering**

先端機械システム学通論

【Code】 10K013 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day &amp; Period】 Tue 5th and Thu 4th 【Location】 C3-Lecture Room 5 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Faculty members from several fields

【Course Description】 Lectures on recent topics in various fields of mechanical engineering will be given in English. This is mainly for foreign students (MC/DC), but Japanese students are also welcome.

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Mechanics	2	Detailed schedule will be announced later.
Materials	2	
Thermodynamics	2	
Fluid dynamics	2	
Control	2	
Design	2	
Microengineering	2	
Examination/Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class will be given every two years; Not given in 2015.

## Design Theory of Man-Environment Systems

建築・都市デザイン論

【Code】 10X412 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,,

【Course Description】 We are now strongly required to extend the design object from the artifact environment to man-environment system in the field of architecture, city, environment, and landscape. It is not enough to construct the general theory of design separated from specific design fields, and we have to develop “ Man-environment System Design Theory ” to organize design objects and design methods, because the feeling and knowledge on design object have a great influence on design process. In this lecture, we explain design theories and design methods in architectural and urban fields from the multiple viewpoints such as architectural and urban planning & design, landscape design, history and design, social system engineering, and environmental engineering. Moreover we will try to illustrate some design projects as case studies.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design Theory of Architectural Structure**

建築構造デザイン論

【Code】10X413 【Course Year】Master 1st 【Term】1st term 【Class day &amp; Period】Fri 4th 【Location】C2-101

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	6	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Theory of Architectural and Environmental Planning

建築環境計画論

【Code】10X414 【Course Year】 【Term】1st term 【Class day & Period】Thu 2nd 【Location】C2-102

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Teruyuki Monnai,

【Course Description】Living environment including architectural and urban space is generated by means of the dynamic interaction between man and environment. We are able to find multi-layered complex relations such as function, performance, meaning and value, changing with the time. The role of design is to read various networks of relations, and to develop them to human living environment. The objectives of this lecture are as follows; 1) to read the principles of multi-layered man-environment relations based on “ semiotics ” , “ design methodology ” , and “ system theory ” , 2) to explore the possibility to design comfortable environments and fascinating landscapes based on those principles of man-environment system.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Basic Theory of Semiotics	4	
Architectural and Urban Semiotics	2	
Development of Townscape Semiotics	2	
Creative Regeneration of Townscape in Historical City Kyoto	1	
System Theory of Design and Evaluation of Living Environment	1	
Development of Design Methodology	2	
Perspective on Theory of Architectural and Environmental Planning	1	
Confirmation of the Learning Degree	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design Theory of Architecture and Human Environment**

人間生活環境デザイン論

【Code】10B035 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】C2-101 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】KANKI Kiyoko,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	2	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Theory of Architecture and Environment Design, Adv.**

生活空間学特論

【Code】10B024 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】C2-213 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Waro Kishu, Takahiro Taji,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Theory of Architectural Design, Adv.**

建築設計特論

【Code】10B013 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Tue 4th

【Location】C2-213 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	3	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

# Design Mechanics for Building Structures

## 建築設計力学

【Code】 10B037 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st 【Location】 C2-101 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 I. Takewaki, M. Tsuji,

【Course Description】 Basic mechanics and inverse problem for design of building structures are explained. Structural optimization methods are also presented. Rational structural design approaches are introduced in place of conventional try-and-error approaches.

【Grading】 Grading is based on the examination at the end of semester.

【Course Goals】 Obtain the knowledge on basic mechanics for design of building structures. Also obtain advanced knowledges on new theories and methodologies of structural optimization and inverse-problem formulations.

### 【Course Topics】

Theme	Class number of times	Description
Fundamentals of mathematical programming	2	Fundamentals of mathematical programming methods are explained. Linear and nonlinear programming methods are introduced and some examples are presented.
Design sensitivity analysis	1	Basic methods of sensitivity analysis for computing derivatives (sensitivity coefficients) of static responses and frequencies of free vibration with respect to variations of design parameters, shape sensitivity analysis with respect to nodal
Application to optimization of framed structures	1	Application of mathematical programming methods to optimization of framed structures is presented.
Earthquake response constrained design	1	Design earthquakes defined in response spectrum and earthquake response constrained design for shear building models
Earthquake response constrained design for response controlled	1	Earthquake response constrained design for response controlled structures and isolated structures including the design of control devices.
Application of optimum design to practical building	1	
Concept of inverse problem	1	Examples of inverse problem in terms of shear building models
Hybrid inverse problem of structural systems	1	Examples of hybrid inverse problem in vibration and classification of hybrid inverse problems. The solution procedure of hybrid inverse mode problems is discussed.
Strain-controlled design method for moment-resisting frames	1	Simple examples are used for understanding fundamental concepts of strain-controlled design.
Inverse problem via design sensitivity analysis	1	An inverse problem formulation via design sensitivity analysis (direct method) is explained.
Earthquake-response constrained design	1	A method of earthquake-response constrained design for shear building models is explained. Design loads in terms of the design response spectrum are used in the design method.
Performance-based Design	1	A design methodology based on the concept of performance-based design is explained.
Exercise 2	1	Exercise on inverse problems.
Confirmation of the Learning Degree	1	

### 【Textbook】

【Textbook(supplemental)】 Design Mechanics and Control Dynamics of Building, Architectural Institute of Japan, 1994.

【Prerequisite(s)】 Mechanics of Building Structures, Basic Linear Algebra, Basic Calculus

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**High Performance Structural Systems Engineering**

高性能構造工学

【Code】10B231 【Course Year】Master Course 【Term】2nd term 【Class day &amp; Period】Wed 2nd

【Location】C2-313 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Keiichiro Suita, Yuji Koetaka,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	7	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Dynamic Response of Building Structures**

建築振動論

【Code】10B046 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Wed 1st

【Location】C2-102 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Urban Disaster Mitigation Engineering

都市災害管理学

【Code】10B241 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】C2-313 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroshi Kawase, Shiichi Matsushima,

【Course Description】The natural disaster to urban society is getting complex and difficult to predict along with the density growth and high performance build-up, and so the risk of the disaster has risen more and more in recent years. Therefore, the necessity of the integrated disaster mitigation measures before the disaster, immediately after the disaster, and long after the disaster is pointed out. In this lecture, we provide the lessons learned from earthquake disaster in the past, prediction methods of strong motions and building damages, earthquake-proof performance evaluation technique in a real building, and a pros and cons of the present building code for the disaster mitigation.

【Grading】Grading will be based on the attendance and report.

【Course Goals】Understand the seismic vulnerability evaluation of structures and urban systems, the disaster impact evaluation scheme, and the disaster prevention countermeasures. Then learn basic knowledge needed to foresee and prepare for the earthquake disaster in future by themselves.

### 【Course Topics】

Theme	Class number of times	Description
Earthquake Mechanism	4	Source mechanisms for disastrous earthquakes
Wave propagation	3	Wave propagation analysis and strong motion simulation
Structural response	3	Modeling of structures and prediction of their responses
Great earthquake disaster	3	Predictions of great earthquake disaster and its environmental impact
Seismic design and retrofit	2	Problems associated with the current building code and retrofitting technology

### 【Textbook】

【Textbook(supplemental)】Ground motion, phenomena and theory(AIJ)

【Prerequisite(s)】Basic knowledge of seismic design

### 【Independent Study Outside of Class】

### 【Web Sites】

### 【Additional Information】

**Environmental Control Engineering, Adv.**

環境制御工学特論

【Code】10B222 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Mon 2nd

【Location】C2-101 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kazunori HARADA,

【Course Description】 This lecture deals with functional aspects of building envelope as a shelter from outdoor climate. Lecture will be given on specified topic on principles of thermal and moisture insulation, control strategy of indoor environment, the prediction methods of air flow, thermal radiation and indoor air quality. Examples will be shown for use in building design for thermal environment control and safety problems during fire.

【Grading】 Score is evaluated by end-term examination.

【Course Goals】 To acquire basic concepts on fundamental concepts on thermal environment control for preparation of master thesis development.

**【Course Topics】**

<b>Theme</b>	<b>Class number of times</b>	<b>Description</b>
introduction	1	The history of numerical methods in architectural environmental control is briefly introduced, followed by introduction of mathematical formulation of physical phenomena.
numerical methods in heat conduction	4	As a common knowledge, heat conduction equation is dealt with in order to understand the basic framework in numerical methods. At the end of this term, report will be obligatory to understand the meaning of discrete equations and their nature.
numerical methods on fluid motion	5	Lecture will be given for standard methods of calculation of fluid dynamics. At the end of this term, simple practice on control volume method and SIMPLE algorithm will be obligatory.
simultaneous system and turbulence	4	Lecture will be given for simultaneous systems of fluid motion and thermal field. In a similar way, turbulence model is to be introduced. The participants are expected to have learned on environmental engineering in architecture at bachelor level.
Evaluation of achievements	1	Evaluation of achievements will be conducted.

【Textbook】 None specified.

【Textbook(supplemental)】 To be specified during the course.

【Prerequisite(s)】 The participants are expected to have learned on environmental engineering in architecture at bachelor level.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design in ICT**

情報通信技術のデザイン

【Code】 693689 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 5th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】 Computers and communication networks are representative complex technical artifacts, but it is not an easy task to perceive their construction principles because their design processes are invisible for us. In this course, we study design principles for information and computer technology (ICT) in terms of (1) hierarchical abstraction, (2) tradeoff, and (3) human and social analogy, being the computers and the communication networks as specific examples. Recent advances and directions for the design of future ICT will be also discussed using the above design principles.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	7	
	6 回に相	
	当	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Industrial mathematics and design**

数理とデザイン

【Code】 693547 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 1st 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,,

【Course Description】 Methodologies of mathematical modeling, statistical data analysis, and mathematical optimization are discussed as mathematical common languages supporting inter-disciplinary viewpoints and design thinking for resolving complex problems in today ' s societies. Various concepts in industrial mathematics used in modeling objects are reviewed to develop high-angle viewpoints for modeling, and data analysis and optimization are lectured as systematic problem-solving methodologies utilizing mathematical modeling. Tools and solvers useful for dealing with practical problems are also reviewed.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Pattern Recognition, Adv.**

パターン認識特論

【Code】 693164 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 2nd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,,,,,

【Course Description】 We first explain fundamentals of pattern recognition, clustering methods with several distance measures, and discriminant functions with their learning methods. We then introduce advanced classifiers such as HMM, SVM and CRF and also related topics of machine learning theory, which includes EM learning, the MDL criteria, and Bayesian learning.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Language Information Processing, Adv.**

言語情報処理特論

【Code】 693125 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 3rd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,,

【Course Description】 This lecture focuses on morphological analysis, syntactic analysis, semantic analysis, and context analysis, including machine learning approaches, which are necessary to process natural language texts. We also explain their applications such as information retrieval and machine translation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Transmission Media Engineering, Adv.**

伝送メディア工学特論

【Code】 693625 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 Mon 3rd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】 This course introduces the following: (1) the technical foundations of wireless and wired transmission technologies such as synchronization; (2) communications link analysis; (3) multiple access and medium access control schemes; and (4) radio resource management based on optimization and game theory.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## ビッグデータの計算科学

【Code】698035 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 5th 【Location】  
 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,,

【Course Description】 Because of the recent progress in a computer or the maintenance of intelligence infrastructure technology, the increase of the quantity of the data generated from the social activity performed through the Internet such as cloud computing and the quantity of the data obtained through the computer simulation which is an important technique of computational science, is being enhanced every day. It is the purpose of this course to study the technique for analyzing and visualizing those big data. In particular, the data analysis to the large sparse matrix is exercised using the C language.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	3	
	3	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Supercomputing, Advanced**

スーパーコンピューティング特論

【Code】 693541 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Tue 5th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】 This lecture is for learning architectural and software issues in supercomputing focusing on parallel high-performance scientific computing. The students will use the supercomputer in ACCMS to learn how a real supercomputer works. The lecture is open to students from any graduate schools whose convenience to attend the lecture is regarded by assigning the fifth period for the lecture.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	3	
	2 ~ 3	
	1 ~ 2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Optimization Theory, Advanced**

最適化数理特論

【Code】693422 【Course Year】Doctor Course 【Term】1st term 【Class day &amp; Period】Thu 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】Lecture on basic optimization theory and algorithm design for solving mathematical programming problems. Topics include duality in nonlinear optimization, interior point methods for linear and convex programming problems, convex optimization approaches to real-world problems.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	6	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Control Systems Theory, Advanced**

制御システム特論

【Code】 693419 【Course Year】 Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 2nd

【Location】 Integrated Research Bldg.-213 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】 This course introduces fundamental ideas regarding robust control theory and explores control system design methods, with system model uncertainty taken into account. The course also discusses the importance of system model uncertainty based on frequency-domain and state-space methods. Topics covered include robust stability conditions and feedback system design that achieves robustness.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
	4	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Statistical Systems Theory

統計的システム論

【Code】 693536 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 Integrated Research Bldg.-111 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】 Introduction to stochastic and statistical models, which appear in various physical/engineering systems. Topics include model selection, statistical signal processing, Kalman filter, application of stochastic analysis, and related matters.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	2	
	2	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Theory of Symbiotic Systems

共生システム論

【Code】 693518 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 Integrated Research Bldg.-213 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】 Various theories on developing and maintaining harmonious symbiosis among humans, artifacts, and environments are lectured and discussed. Topics include typical forms of harmonious coexistence such as in ecological systems, caring and artistic nature of communication and interactions, philosophical discussions on deep-ecology, and methodologies for designing symbiotic systems.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	3	
	3	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Social Informatics**

情報社会論

【Code】693247 【Course Year】Doctor Course 【Term】1st term 【Class day &amp; Period】Wed 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,,,,,

【Course Description】 This course introduces social issues dealing with the impact of information technology on society: information policy, information and law, information and economics, information ethics, and information and education. Students will learn the social aspects of information technology from multi-disciplinary viewpoints: the history and trends of information technology; problematic issues regarding an information society; social revolution brought on by information technology, privacy, and security issues; policies concerning information, intellectual properties, and the way IT experts think and the responsibilities they bear.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Information and Intellectual Property

情報と知財

【Code】 698014 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 Engineering Science Depts Bldg.-315 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】 This course introduces the copy right law and copy rights of digital contents, the patent law and patents related to IT area (software patent, business model patent etc.), information technology for management and creation of intellectual properties, the law for the protection of computer-processed personal data held by administrative organs, information ethics and information security. Students are required to acquire the fundamental knowledge of the copy right law, the patent law, information technology for management and creation of intellectual properties, the law for the protection of computer-processed personal data held by administrative organs, information ethics and information security.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Information Network**

情報ネットワーク

【Code】 693628 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,

【Course Description】 This course introduces architecture of information networks including communication protocol and layered structure. Various networks and their technologies, such as circuit switching network, IP network, photonic network, and mobile network, are explained.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 <http://www.i.kyoto-u.ac.jp/curriculum/syllabus.html>

## Information Systems Design

情報システムデザイン

【Code】 10X433 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Thu 3rd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,,,,,

【Course Description】 This course introduces fundamental concepts, methodologies and underlying technologies for analyzing, designing and implementing social information systems. In particular, the course presents fundamental concepts regarding object-oriented computing, object-oriented design and analysis methodology, database design, user interface design, and design and practice of Web-based information systems including databases. Students will examine design methodology and implementation/operation technologies to learn how information systems are designed, implemented and operated. In conjunction with lectures, students will complete exercises on information system design so that they may understand the theory and technology by applying them to real information system design.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Computational Learning Theory**

計算論的學習理論

【Code】 10X436 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Statistical Learning Theory**

統計的学習理論

【Code】 10X438 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Information Organization and Retrieval**

情報組織化・検索論

【Code】 10X440 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Distributed Information Systems**

分散情報システム

【Code】 10X442 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## 情報システム分析論

【Code】 693254 【Course Year】 【Term】 【Class day & Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Business Design**

事業デザイン論

【Code】10X452 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 3rd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】 This course is a practical business-design workshop in a leading Graduate School of Design. We learn business plan generation such as new business planning, evaluation and improvement on an existing business, and developing new innovative idea for an existing business. In this course, we learn the business planning framework “ Business Model Canvas” in a book Business Model Generation. And using this framework we learn wide variation of business components and adjustment of them so as to form a whole system. We will be able to plan a comprehensive and consistent business. Therefore, this class consists of lecture on business components, mini group discussion, group work and presentation to analyze of an existing business model and to plan a reform plan base on “ Business Model Canvas. ”

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Design Management

デザイン経営論

【Code】10X453 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Mon 5th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】 Nowadays, "design" has become more and more important factor in business field. In this course, we discuss the various aspects of design in the business context, which are design strategies, marketing, customer experience, creative organizations and service design as well as a definition of a design. Furthermore, students learn ways of thinking such as "functional approach" and "design thinking." In addition, "designer's elaboration" is also learned. This course is planned for students who want to obtain a broad perspective of relationship between design and management.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	2	
	2	
	2	
	3	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Magaging Innovation: From R&D towards New Business Development**

研究・事業開発マネジメント

【Code】10X454 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Fri 3rd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,

【Course Description】 Innovation management is increasingly important for enterprises to sustain their businesses. However, it would not be easy, in particular, for Japanese enterprises to conduct innovation management with an entrepreneur mindset. In order to learn innovation management with entrepreneurship, we will focus on the innovation process from R&D towards composing strategies for new business development in this course. Over the semester, we will learn key innovation management aspects, e.g., finding business opportunities, making business models, figuring finance models, analyzing existing business with SEC annual reports, and designing value creation processes. The course consists of lectures, case analyses, special lectures given out by visiting experts, and student presentations based on the knowledge that they gained throughout this course. Those who wish to work for global businesses, business development for high-tech industries, start-ups, service design management, etc., are welcome to enroll.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	3	
	2	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Marketing Research**

マーケティングリサーチ

【Code】 10X456 【Course Year】 Doctor Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】 This course (Marketing Research) is designed to give an overview or process of marketing in order to identify and solve marketing problems. It focuses not only on giving fundamental knowledge but also on applying its knowledge to marketing problems. It should be practical.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



## Seminar on Psychology and Design Studies

心理システムデザイン演習

【Code】 10X462 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,,,,,

【Course Description】 This course aims to deepen students' research content. Faculty and students will provide presentations and engage in mutual discussions of the latest research. This will help students acquire broader knowledge of diverse specialized disciplines. Students will also examine and discuss literature selected from related disciplines. The course will help students discover new directions for research by helping them plot their research themes on a time axis (the flow of students' research from the past to the present) and on a space axis (the relationship of students' research to research being conducted in neighboring disciplines). It will also help them reexamine their research in relation to these axes. This course has three objectives related to students' research themes: (1) deepening students' abilities to think so they can achieve higher standards; (2) deepening students' understanding of the latest research trends in various specialized fields; (3) helping students acquire skills needed to report research in an interesting, easily-understandable way; and (4) helping students acquire skills required to conduct constructive discussions.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Seminar on Psychology and Design Studies

心理システムデザイン演習

【Code】10X463 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】,,,,,

【Course Description】 This course aims to deepen students' research content. Faculty and students will provide presentations and engage in mutual discussions of the latest research. This will help students acquire broader knowledge of diverse specialized disciplines. Students will also examine and discuss literature selected from related disciplines. The course will help students discover new directions for research by helping them plot their research themes on a time axis (the flow of students' research from the past to the present) and on a space axis (the relationship of students' research to research being conducted in neighboring disciplines). It will also help them reexamine their research in relation to these axes. This course has three objectives related to students' research themes: (1) deepening students' abilities to think so they can achieve higher standards; (2) deepening students' understanding of the latest research trends in various specialized fields; (3) helping students acquire skills needed to report research in an interesting, easily-understandable way; and (4) helping students acquire skills required to conduct constructive discussions.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Seminar on Data Analysis in Psychology and Design Studies

心理デザインデータ解析演習

【Code】10X464 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】,,

【Course Description】 This course will review the major methods used in multivariate data analysis (factor analysis, regression analysis, structural equation modeling, etc.) of psychological data employed during the exploration of human cognition and design processes. The primary goal of this course is to increase students' abilities to understand and perform these types of statistical analyses on their own experimental data. Students will learn to use a number of software packages (SPSS, R, etc.). In addition, students will acquire the skills required to write high-level academic papers.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Design of Cognitive Functions

認知機能デザイン論

【Code】 10X465 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Wed 4th 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 【Instructor】 ,

【Course Description】 This course explains recent findings related to the relationship that exists between the brain and cognitive function. Primary focus is placed on frontal lobe functions, memory, emotion, and social cognition. The objectives of this course are to help students develop a foundation in cognitive neuroscience and to help students employ this knowledge in their research. These objectives will be achieved by presenting essential knowledge in the simplest manner possible. Students will acquire and improve their developmental and constructive thinking abilities by discussing lectures presented by eminent researchers worldwide.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



## Seminar on Brain Function and Design Studies

脳機能デザイン演習

【Code】10X467 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】 This seminar, which is primarily rooted in neuroscience, is aimed at graduate students who are currently engaged in research or are interested in engaging in research related to cognition, emotion, and broader areas in the life sciences. Students will participate in a review of research that may serve as a background to students' own areas of interest. This course will consider practical aspects involved in the study of human cognition at an advanced level. Topics include experiment planning, measurement of brain functions, data analysis and interpretation, and drafting and completion of research papers.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Field based Learning/Problem based Learning (FBL/PBL) 1**

問題発見型 / 解決型学習 (FBL/PBL) 1

【Code】 10X471 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】 This course is designed to enable students to put design theories and design methods into practice and to acquire these theories and methods. In Field based Learning (FBL), students can experience the process of finding the problems to be solved from a given real-world fields as a team project. In Problem based Learning (PBL), students can experience the process of solving a given real-world problem as a team project.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Field based Learning/Problem based Learning (FBL/PBL) 2**

問題発見型 / 解決型学習 (FBL/PBL) 2

【Code】 10X472 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】 This course is designed to enable students to put design theories and design methods into practice and to acquire these theories and methods. In Field based Learning (FBL), students can experience the process of finding the problems to be solved from a given real-world fields as a team project. In Problem based Learning (PBL), students can experience the process of solving a given real-world problem as a team project.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Open Innovation Practice 1

オープンイノベーション実習 1

【Code】 10X473 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】 This course facilitates additional skills development opportunities. Especially students are expected to train the skills necessary to develop and manage their careers across a broad range of employment sectors, including academia in design. To attain this, students are to conduct with the relevant specialists and stakeholders and to appreciate the importance of initiating new projects for open innovation, proactively reacting to newly identified needs or aiming to resolve persistent problems. For this problem solving, students are requested to form a team and to develop and maintain effective relationships with colleagues by working in a collaborative environment and to organizing a series of workshops with those colleagues. Through these practices, students are obliged to understand leadership in team environments, recognizing the strengths of team members and work effectively to achieve mutual goals as well as to understand the role of innovation and creativity in research. Students are to respond to abstract problems that expand and redefine existing procedural knowledge. Also they are required to demonstrate effective writing and publishing skills, demonstrating design methodologies and exhibiting knowledge of design theories.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Open Innovation Practice 2

オープンイノベーション実習 2

【Code】 10X474 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】 This course facilitates additional skills development opportunities. Especially students are expected to train the skills necessary to develop and manage their careers across a broad range of employment sectors, including academia in design. To attain this, students are to conduct with the relevant specialists and stakeholders and to appreciate the importance of initiating new projects for open innovation, proactively reacting to newly identified needs or aiming to resolve persistent problems. For this problem solving, students are requested to form a team and to develop and maintain effective relationships with colleagues by working in a collaborative environment and to organizing a series of workshops with those colleagues. Through these practices, students are obliged to understand leadership in team environments, recognizing the strengths of team members and work effectively to achieve mutual goals as well as to understand the role of innovation and creativity in research. Students are to respond to abstract problems that expand and redefine existing procedural knowledge. Also they are required to demonstrate effective writing and publishing skills, demonstrating design methodologies and exhibiting knowledge of design theories.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Filed Internship**

フィールドインターンシップ (デザイン学)

【Code】 10X475 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】 This course provides a program of field internship in which doctoral students are sent to external fields out of the campus (either of domestic or abroad) for mid- or long-term periods of 30 days or longer to be engaged in the group work. The proposals to attend the international internship programs organized by the third parties such as IAESTE, ISEC, and Vulcanus are also accepted. Recipients are selected via a competitive assessment process evaluated at the steering committee as well as by overseas researchers. Recipients are obliged to exhibit knowledge of advances and developments in design and to demonstrate knowledge by comprehending and effectively employing appropriate design methodologies. Recipients are obliged to be monitored during their stay by their mentors and to give a debriefing presentation when they come back from the internship.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Research-Intensive Abroad Internship

リサーチインターンシップ (デザイン 学)

【Code】 10X476 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】 This course provides a program of international internship in which doctoral students are sent to our partner institutions for mid- or long-term periods of 30 days or longer to foster leadership in collaborative research environments. This program fosters students capable of creating and developing novel academic and research fields with a vision that crosses different academic boundaries and is to let them conduct independent and autonomous research projects. The proposals to attend the international mid-term schools organized by our partnership institutions are also accepted. Recipients are selected via a competitive assessment process evaluated at the steering committee as well as by overseas researchers with respect to feasibility, significance, preparedness etc. of the proposed plans. Recipients are obliged to be monitored during their stay by their mentors and to give a debriefing presentation when they come back from the internship.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design Science Exercise, Adv. 1**

デザイン学特別演習

【Code】 10X481 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Design Science Exercise, Adv. 2**

デザイン学特別演習

【Code】 10X482 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day &amp; Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Communication Methodology Seminar

戦略的コミュニケーションセミナー（日本語）

【Code】 698561 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day & Period】

【Location】 【Credits】 1 【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】 This seminar is a short-term intensive seminar to enhance the ability of communication, and consists of Japanese and English courses.

The aim of Japanese course is to strengthen the ability to speak and communicate in the scenes of giving a speech, conducting negotiations. Executive announcers of the Japanese center of NHK Communications Training Institute conduct the seminar by concentrating the know-how owned by the center.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Communication Methodology Seminar**

戦略的コミュニケーションセミナー（英語）

【Code】 698562 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day &amp; Period】

【Location】 【Credits】 1 【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 ,

【Course Description】 This seminar is a short-term intensive seminar to enhance the ability of communication, and consists of Japanese and English courses.

The aim of English course is to strengthen presentation skills and speaking skills in English. Instructors of Berlitz Japan conduct the seminar by concentrating the rich contents owned by the Berlitz Japan.

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Informatics Practice I**

情報学演習

【Code】 698581 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Tue 4th

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】

【Instructor】 ,

【Course Description】 This course is dedicated for non-CS (computer science)-major students to understand fundamental information technologies and acquire “ information skills ” through practices. Enrolled students learn fundamental information technologies and acquire the ability of “ information literacy ” for acquiring, generating, managing, analyzing, and presenting information.

Practices in this course include computer programming, but neither programming experience nor knowledge of specific programming language are required.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	7	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Informatics Practice II

情報学演習

【Code】 698582 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese

【Instructor】 ,

【Course Description】 This practice course is to explore and identify “ information skills ” that are needed in the research of architecture, mechanical engineering, pedagogy, and management science. Information-skill topics are designed by enrolled students themselves in a workshop style. Possible practice topics are (A) Web programming, (B) Web-based survey (crowd-sourcing), (C) 3D CG contents creation, (D) Human behavior analysis, (E) Information Design, and (F) Algorithmic architecture.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	6	
	6	
	6	
	6	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】





**Communication Strategies for Design Research**

デザイン学コミュニケーションストラテジー

【Code】 10X490 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Management Research Methodology**

経営研究方法論

【Code】 10X493 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Management Research**

経営調査論

【Code】 10X494 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Polymer Design for Biomedical and Pharmaceutical Applications**

医薬用高分子設計学

【Code】10H636 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】Mon 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Introduction to the Design and Implementation of Micro-Systems

微小電気機械システム創製学

【Code】 10V201 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 C3-Lecture room 1 or 3 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture and Pactice 【Language】 English

【Instructor】 O. Tabata,H. Kotera,T. Tsuchiya,R. Yokokawa,

【Course Description】 This is a joint lecture with Hong Kong University of Science and Technology (HKUST). A team consists of two students from each University work together to fullfill the assignment (design a microsystem) through paper survey, analysis,design, and presentation. A student can acquire not only the basic knowledge of a microsystem, but also comprehensive ability of English such as technical knowledge in English, skill for team work, and communication.

【Grading】 Presentation, Assignments, and Achievement

【Course Goals】 Acquire the knowledge and skill to design and analyze a microsystem.

【Course Topics】

Theme	Class number of times	Description
Tutorial on microsystem CAD software	3	Master CAD program for microsystem design and analysis which will be utilized to accomplish an assignment.
Lecture and Task Introduction	2	Learn basic knowledge necessary to design a microsystem/MEMS(Micro Electromechanical Systems) utilizing microfabrication technology.
Design and analysis work	3	Analyze and design a microsystem by communicating with a team member of HKUST.
Presentation I	2	The designed device and its analyzed results is presented in detail by team in English.
Evaluation of device	3	Evaluate the fabricated microsystem.
Presentation II	2	The measured results and comparison between the analyzed results of the fabricated microsystem is presented by team in English.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering" provided in 1st term.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student of this class is required to register to the course 10G205 "Microsystem Engineering" provided at Friday 4th so as to be able to take consecutive classes at Friday 4th and 5th. Those who want to take this course have to take training course for CAD in advance. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term.

**Micro Process and Material Engineering**

マイクロプロセス・材料工学

【Code】 10G203 【Course Year】 Master Course 【Term】 1st term 【Class day &amp; Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Kotera,O. Tabata,K. Eriguchi,I. Kanno,T. Tsuchiya,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Semiconductor microfabrication	3	
Thin-film process and evaluation	3	
Silicon micromachining	3	
3D lithography	3	
Soft-micromachining	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Multi physics Numerical Analysis**

マルチフィジクス数値解析力学

【Code】 10G209 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Wed 1st

【Location】 Engineering Science Depts Bldg.-101 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	5	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to Biomedical Engineering**

医工学基礎

【Code】10W603 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd  
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice  
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

### 【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

### 【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Microsystem Engineering

マイクロシステム工学

【Code】 10G205 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Fri 4th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 O. Tabata, H. Kotera, T. Tsuchiya, R. Yokokawa,

【Course Description】 Microsystem covers not only technologies related to individual physical or chemical phenomenon in micro scale, but also complex phenomena which are evolved from their interaction. In this course, the physics and chemistry in micro and nanoscale will be lectured in contrast to those in macro scale. The various kinds of application devices (ex. physical (pressure, flow, force) sensors, chemical sensors, biosensors, actuators (piezoelectric, electrostatic, and shape memory) and their system are discussed.

【Grading】 The evaluation will be based on the reports given in each lecture.

【Course Goals】 Understand the theory of sensing and actuating in microsystem. Acquire basic knowledge to handle various kinds of phenomena in microscale.

### 【Course Topics】

Theme	Class number of times	Description
MEMS modeling	2	Multi-physics modeling in microscale. Electro-mechanical coupling analysis.
MEMS simulation	2	System level simulation in MEMS.
Electrostatic microsystem	3	Electrostatic sensors and actuators. Theory and application devices.
Physical sensors	4	Physical sensors as a fundamental application in microsystem. Accelerometer, vibrating gyroscope, pressure sensors.
Micro total analysis system	4	Chemical analysis system and bio-sensing device using microsystem.

【Textbook】 Provided in the lecture.

【Textbook(supplemental)】 Provided in the lecture.

【Prerequisite(s)】 Students are required to take the 10G203 course "Micro Process and Material Engineering".

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student can register only to this class 10G205, but it is required to be able to take consecutive classes at Friday 4th and 5th. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term. The student of this class is strongly recommended to take a course 10V201 "Introduction to the Design and Implementation of Micro-Systems"(10V201), which is a practice for designing microsystem. Those who want to take 10V201 have to take training course for CAD in advance.



## Polymer Physical Properties

高分子物性

【Code】10H652 【Course Year】Master Course 【Term】1st term 【Class day & Period】Thu 2nd

【Location】A2-307 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirokazu Hasegawa, Takenao Yoshizaki, Tsuyoshi Koga, Mikihiro Takenaka, Hiroyuki Aoki,

【Course Description】A concise explanation is given of physical properties of polymer solutions and polymeric solids along with relevant basic theories.

【Grading】Final grades will be evaluated in a comprehensive manner on the basis of attendance, reports, and examinations.

【Course Goals】Fundamental knowledge of physical properties of polymer materials.

【Course Topics】

Theme	Class number of times	Description
Polymer Chain Conformation in Dilute Solutions	3	After a clarification of basic factors which determine the conformations of real polymer chains in dilute solutions, some polymer chain models are introduced to describe the equilibrium conformational behavior of the real chains. Further, behavior of average chain dimensions as a functions of molecular weight is considered based on the chain models.
Thermodynamics and Phase Behavior of Polymer Solutions	3	Various phase transition phenomena in polymer solutions (phase separation, hydration, association, gelation, etc.) are systematically explained from thermodynamic and statistical-mechanical viewpoints. "Phase separation of polymer solutions", "Aqueous polymer solutions", and "Association and gelation of polymers" are discussed in the lectures.
Exercise	1	Exercise in polymer solutions.
Structure and Mechanical Properties of Polymeric Solids	4	Polymeric solids such as rubber and plastics, especially thermodynamics of rubber elasticity, polymer crystallization and crystalline/amorphous higher-order structures, are discussed. Moreover, fundamentals of viscoelastic properties of polymers are introduced to provide the understandings of relaxation phenomena such as glass transition.
Electronic and Optical Properties of Polymeric Solids	3	The electronic and optical properties of polymers is reviewed. The application of polymer materials in the opto-electronics and display devices is also presented.
Exercise	1	Exercise in polymeric solids.

【Textbook】Lecture notes distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】Fundamental knowledge of physical chemistry.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



## Polymer Structure and Function

高分子機能学

【Code】 10H613 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 S. Ito, H. Ohkita, H. Aoki,

【Course Description】 Polymers are indispensable in our modern society, fundamental in industry, and functional for chemistry, medicine, electronics, and many other advanced and emerging technologies. In this class, photo- and electric functions of polymeric materials are discussed on the basis of photochemistry and photophysics. In particular, the importance of designing nanostructures of polymer assembly is highlighted by explaining examples of state-of-the-art real systems.

【Grading】 Evaluated with the grade on the final test or the quality of report submitted after the final class.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Conductive Polymers	2	
Photofunctional Polymers	3	
Nanostructure and Dynamics of Polymers	2	
Optoelectronic Polymers	3	

【Textbook】 None: Some handouts will be dealt in the class of every lecture.

【Textbook(supplemental)】 None:

【Prerequisite(s)】 Students are expected to have knowledge of Physical Chemistry and Polymer Chemistry provided in chemistry course of undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This lecture is held every other year, not offered in 2015.

**Biomacromolecular Science**

生体機能高分子

【Code】10H611 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Tue 2nd

【Location】A1-001 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomaterials Science and Engineering**

高分子医工学

【Code】10H633 【Course Year】Master and Doctor Course 【Term】1st term 【Class day &amp; Period】Fri 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	2	
	2	
	1	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Engineering for Chemical Materials Processing**

化学材料プロセス工学

【Code】 10H021 【Course Year】 Master and Doctor Course 【Term】 【Class day &amp; Period】 Wed 4th

【Location】 A2-302 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 M.Ohshima,S.Nagamine,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	1	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemistry of Polymer Materials**

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day &amp; Period】Fri 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
	3	
	2	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Chemistry of Biomaterials**

生体材料化学

【Code】10H031 【Course Year】Master Course 【Term】 【Class day &amp; Period】Tue 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	12	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Synthesis of Polymer Materials,Advanced**

高分子材料合成特論

【Code】10S022 【Course Year】Doctor Course 【Term】2nd term 【Class day &amp; Period】Fri 5th

【Location】A2-302 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Functionalized Nucleic Acids Chemistry

機能性核酸化学

【Code】10H426 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Nishimoto and Tanabe,

【Course Description】 A number of challenges have been made on development of modified DNA, RNA and proteins, chemical or physical properties of which are controlled by several triggers. These intelligent materials are promising for next generation gene diagnostics and therapy. In this lecture, we discuss the molecular design of these artificial biological materials and their application.

【Grading】 attendance and report (or term-end examination)

【Course Goals】 Synthetic chemistry of DNA, RNA and protein//Chemical structure and basic function of biological materials//Regulation of biological function//Medical applications of artificial DNA, RNA and protein

【Course Topics】

Theme	Class number of times	Description
Chemical structure and synthesis	2	Synthetic chemistry of nucleic acids
Gene manipulation	2	Synthesis of protein Gene Sequencing
Functions of intelligent molecules	2	Function of artificial peptides Functions of artificial nucleic acids
Drugs related to DNA	2	DNA cleavage by drugs Crosslinking by artificial nucleic acids Alkylation by drugs
Expansion of genetic code	2	Artificial nucleobases Synthesis of modified protein in cells
Medical application	2	Molecular targeting Molecular imaging
Recent topics	3	

【Textbook】

【Textbook(supplemental)】 No textbooks are used.

【Prerequisite(s)】 Basic knowledge in organic chemistry and biological chemistry is requisite.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Biology**

分子生物化学

【Code】10H812 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 2nd  
 【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese  
 【Instructor】.,

【Course Description】 Biological responses are elicited at the interface of intrinsic genetic information and extrinsic environmental factors. This course discusses on molecular aspects of brain function and immunity. Experimental tools such as fluorescent probes for second messenger molecules are also explained through performance of experiments using the probes.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basics	1	
Principles of neurotransmission	3	
Immunity and inflammation	2	
Gaseous bioactive molecules	2	
Experiments to observe cellular responses	3	

【Textbook】 Provided in the course

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biorecognics**

生体認識化学

【Code】 10H815 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Thu 2nd

【Location】 A2-308 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Bioorganic Chemistry**

生物有機化学

【Code】10H813 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day &amp; Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	1	
	1	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Microbiology and Biotechnology**

生物学

【Code】10H816 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd  
 【Location】A2-308 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English  
 【Instructor】Haruyuki Atomi, Tamotsu Kanai

【Course Description】 This lecture will introduce the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. Commonly used tools in the fields of biochemistry, molecular biology and genetics will also be discussed. In addition, methods to utilize cells and their enzymes in biotechnology will be introduced. Lectures will be given in English, with the aim to improve communication/discussion skills.

【Grading】 Grading will be based on presentations (60%) and attendance (40%).

【Course Goals】 Basic knowledge on the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. An understanding of the commonly used tools in the fields of biochemistry, molecular biology and genetics as well as methods to utilize cells and their enzymes in biotechnology. Lectures will be given in English, with the aim to improve communication/discussion skills.

**【Course Topics】**

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Introduction	1	Diversity of life, classification of organisms, structure and function of fundamental biomolecules.
Basic mechanisms to sustain life	3	Strategies to conserve energy, biosynthesis, cell division, cell differentiation.
Strategies to adapt to environmental conditions	2	Effect of environmental conditions on cells and biomolecules, thermophiles, acidophiles and their enzymes.
Protein engineering	2	Methods to study enzymes and enzyme reactions, methods to enhance their performance.
Cell engineering	2	Methods utilized in metabolic engineering, cell surface engineering, synthetic biology.
Topic discussion	1	Particular topics will be chosen for discussion

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Organic Chemistry**

先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】Tue 1st

【Location】A2-306 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Jun-ichi Yoshida and other professors

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	<small>Class number of times</small>	<b>Description</b>
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Reactions
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	1	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Organic Chemistry 2 Continued**

先端有機化学統論

【Code】10P818 【Course Year】Master 1st 【Term】1st term 【Class day &amp; Period】Tue 1st

【Location】A2-306 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Biological Chemistry**

先端生物化学

【Code】10H836 【Course Year】Master Course 【Term】1st term 【Class day &amp; Period】 【Location】A2-308

【Credits】3 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	3	
	4	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Biological Chemistry 2 Continued**

先端生物化学続論

【Code】 10P836 【Course Year】 Master Course 【Term】 【Class day &amp; Period】 【Location】 【Credits】 1

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomolecular Function Chemistry**

生体分子機能化学

【Code】 10H448 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day &amp; Period】 Mon 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Shirakawa, Sugase

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomechanics**

バイオメカニクス

【Code】 10V003 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day &amp; Period】 Wed 4th

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

<b>Theme</b>	Class number of times	<b>Description</b>
Introduction	1	
	2	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomolecular Dynamics**

生体分子動力学

【Code】 10D450 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day &amp; Period】 Thu 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	3	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Robotics**

ロボティクス

【Code】 10B407 【Course Year】 Master Course 【Term】 2nd term 【Class day &amp; Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Fumitoshi Matsuno,

【Course Description】 Understanding of intelligent behaviors of living things is very interesting. And realization of their intelligent motion by a robot is also attractive for mechanical engineering. In this lecture, we consider basic understanding of beautiful human skill “ manipulation ” on the point of view of dynamics and control. First modeling methodologies for a rigid multibody system and a general dynamic model of a manipulator are provided. Next, a typical nonlinear control law is introduced and some problems for applying the controller are shown. Based on nature of the dynamics of the manipulator, a very simple and robust controller can be derived by designing energy of the system. This lecture provides modeling methodologies and controller design strategies of the rigid multibody system and we analyze a beautiful human skill of the manipulation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	3	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Materials**

分子機能材料

【Code】 10H413 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day &amp; Period】 Wed 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 A. Ito

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

## Special Topics in Transport Phenomena

移動現象特論

【Code】 10H002 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day & Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowlter, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Advanced Topics in Transport Phenomena ( English lecture )**

Advanced Topics in Transport Phenomena

【Code】 10H003 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day &amp; Period】 Tue 4th 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

## 【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	2	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowltzer, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】



**Mechanics and Dynamics, Fundamental**

機械工学基礎

【Code】 10X601 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Continuum Mechanics(Integrated Medical Engineering)**

連続体力学 (総合医療)

【Code】 10X602 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Electronics**

医用電子工学

【Code】10X603 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Basic Material Chemistry**

材料化学基础

【Code】 10X604 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Molecular Analysis of Life**

生物分子解析学

【Code】 10X605 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Image Processing Basics**

画像処理の基礎

【Code】 10X606 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biopharmaceutics**

薬物動態学

【Code】 10X607 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Human Anatomy**

人体解剖学

【Code】 10X608 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Physiology(Integrated Medical Engineering)**

生理学 (総合医療)

【Code】 10X609 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Chemistry**

医化学

【Code】10X610 【Course Year】 【Term】2nd term 【Class day &amp; Period】 【Location】 【Credits】2 【Restriction】

【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Geriatrics, Gerontology, and Aging Science**

加齡医学

【Code】 10X611 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Ethics**

医療倫理

【Code】 10X613 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Introduction to numerical simulation**

シミュレーション概論

【Code】 10X614 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Health Economics**

医療経済論

【Code】 10X615 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Intellectual Property & Global Standardization**

知的財産 &amp; 国際標準化

【Code】 10X616 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Genome cohort study**

ゲノムコホート研究

【Code】 10X617 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Regenerative Medicine**

再生医学

【Code】 10X618 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Engineering for Society I**

医療工学特別講義

【Code】 10X631 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical Engineering for Society II**

医療工学特別講義

【Code】 10X632 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Diagnostic Pathology : lecture**

病理画像診断学：講義

【Code】10X700 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Radiology · MRI introduction : lecture**

放射線画像診断学 · MRI 画像診断学 : 講義

【Code】10X701 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Minimally invasive therapeutics: lecture**

低侵襲治療学：講義

【Code】 10X702 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomaterials and Artificial Organs: lecture**

生体材料学・人工臓器学：講義

【Code】 10X703 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical informatics : lecture**

医療情報学：講義

【Code】 10X704 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Inspection equipment studies Science research equipment : lecture**

検査機器学・研究機器学：講義

【Code】10X705 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical and life support systems : lecture**

医療・生活支援システム学：講義

【Code】10X706 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Diagnostic Pathology: practice**

病理画像診断学：実習

【Code】 10X707 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Radiology · MRI introduction:practice**

放射線画像診断学 · MRI 画像診断学：実習

【Code】10X708 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Minimally invasive therapeutics: practice**

低侵襲治療学：実習

【Code】 10X709 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Biomaterials and Artificial Organs: practice**

生体材料学・人工臓器学：実習

【Code】 10X710 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical informatics: practice**

医療情報学：実習

【Code】 10X711 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Inspection equipment studies Science research equipment: practice**

検査機器学・研究機器学：実習

【Code】10X712 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Medical and life support systems: practice**

医療・生活支援システム学：実習

【Code】 10X713 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**debate I**

英語 debate

【Code】10X641 【Course Year】 【Term】2nd term 【Class day &amp; Period】 【Location】 【Credits】1 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**debate**

英語 debate

【Code】 10X642 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**debate**

英語 debate

【Code】10X643 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**debate**

英語 debate

【Code】10X644 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**debate**

英語 debate

【Code】10X645 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship in Foreign Countries**

短期海外インターンシップ

【Code】 10X661 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Internship (industrial and public parties)**

企業インターンシップ

【Code】 10X662 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Experiments and Exercises on Integrated Medical**

総合医療工学分野特別実験および演習第一

【Code】 10X671 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Experiments and Exercises on Integrated Medical**

総合医療工学分野特別実験および演習第二

【Code】 10X672 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Integrated Medical Engineering Seminar A**

総合医療工学分野セミナー A ( 修士 )

【Code】10X681 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Integrated Medical Engineering Seminar B**

総合医療工学分野セミナー B ( 修士 )

【Code】 10X682 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Special Seminar A on Integrated Medical Engineering**

総合医療工学分野特別セミナー A

【Code】 10X683 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Special Seminar B on Integrated Medical Engineering**

総合医療工学分野特別セミナー B

【Code】 10X684 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Special Seminar C on Integrated Medical Engineering**

総合医療工学分野特別セミナー C

【Code】 10X685 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

**Special Seminar D on Integrated Medical Engineering**

総合医療工学分野特別セミナー D

【Code】 10X686 【Course Year】 【Term】 【Class day &amp; Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

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デザイン 工学研究科附属情報センター

## 工学研究科シラバス 2015 年度版

- ・ [A] Common Subjects of Graduate School of Engineering
- ・ [B] Master's Program
- ・ [C] Advanced Engineering Course Program
- ・ [D] Interdisciplinary Engineering Course Program
- ・ オンライン版 <http://www.t.kyoto-u.ac.jp/syllabus-gs/>

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