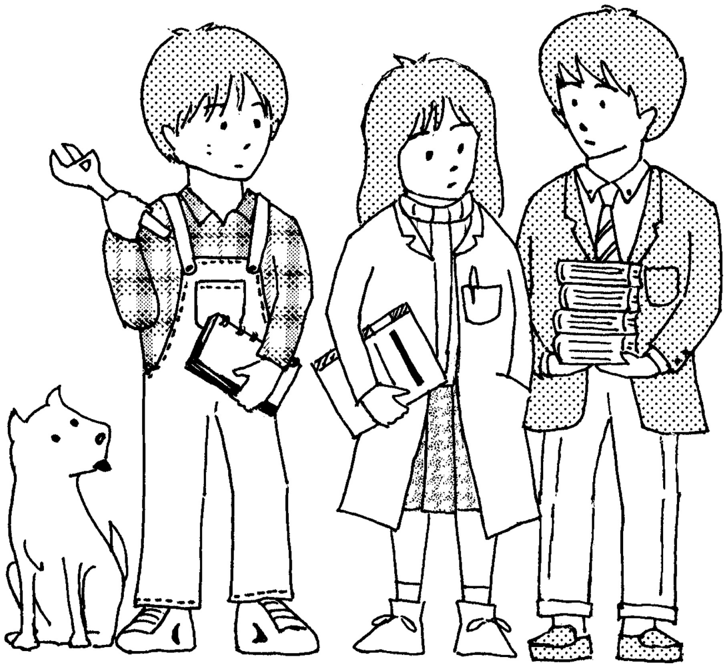
SYLLABUS 2017

[D] Interdisciplinary Engineering Course Program



Kyoto University, Graduate School of Engineering

[D] Interdisciplinary Engineering Course Program

Laboratory of Applied Mechanics

Laboratory of Materials Engineering and Chemistry

Laboratory of Engineering for Life Science and Medicine

Laboratory of Interdisciplinary Photonics and Electronics

Laboratory of Human Security Engineering

Laboratory of Design Science

Laboratory of Integrated Medical Engineering

10G047

Applied Mechanics
応用力学

【Code】10G047 【Course Year】Master 1st 【Term】1st term 【Class day & 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】

10X411

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 & Period】Fri 3rd

【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
	2	
	2	
	2	
	2	
	2	
	2	

【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 foreing 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 annouced 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 2017.

10K005

Advanced Modern Science and Technology（English lecture）

現代科学技術特論 (英語科目)

【Code】10K005 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system) 【Restriction】No Restriction
【Lecture Form(s)】Relay Lecture 【Language】English
【Instructor】 GL Edu. Center, J. Assoc. Prof., Ryosuke Matsumoto
Related professors
【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】Students who choose the academic semester system must meet the requirements for the first 11 lecturers and the latter 4 lecturers separately.
When evaluating your grade, I employ the average score of best four reports for students who chose the modified quarter system, and best five reports for students who chose academic semester system.
Please go to KULASIS Web site. You can find an attachment file, ”通知版：2016 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
Exploration of Radiation Belts by Space Radio Engineering	1	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.(Y. Omura: Dept. of Electrical Engineering)
Functional Organic Molecular Materials for Molecular Scale Nanoscience	1	This lecture explains functional organic molecular materials with functions like photochromism or molecular conductance, which are expected to play an active role in molecular scale nanoscience.(K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
Micro- and Nano-scale Separations in Analytical Chemistry	1	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.(K. Otsuka: Dept. of Material Chemistry)
Role of Nanoparticles Aiming at Theranostic Agents for Solid Cancers － Sustainable Universe Health Care in the Aged Society	1	Malignancy takes the first position for the cause of mortality in Japan. Realization of a “ society of health and longevity ” therefore requires a general method for diagnosis and therapy for cancers in the early stage. Nanoparticles are currently highly expected to this type of medicinal treatment, because nanoparticles can avoid expensive therapy, which would bankrupt our universal health care system.(S. Kimura: Dept. of Material Chemistry)
What are polymers?	1	What is a polymer? Also, what is the difference between polymers and other molecules? The characteristics of polymers and polymerizations are explained with some examples on practical applications of polymers.(M. Ouchi: Dept. of Polymer Chemistry)
Precision Polymerization and Functional Materials by Macromolecular Design	1	The methodology to synthesize polymers precisely and their features are described. In addition, some examples on functional materials using polymers whose molecular design is important are introduced.(M. Ouchi: Dept. of Polymer Chemistry)
Analysis and Design of Socio-Technical Systems	1	When introducing various kinds of automation systems including robots into a new work environment, it is necessary to design and analyze from the viewpoint of socio-technical systems, which is the interaction system of people, technology and organization. In this lecture, specific problems and solutions are described.(T. Sawaragi: Dept. of Mechanical Engineering and Science)
Computational Chemistry and computer science	1	Remarkable progress in the computer science has been revolutionizing scientific research and technological development for this decade. This trend will further accelerate in the future. This lecture reviews the impact of state of the art computer science on the molecular chemistry as an example.(R. Fukuda: Dept. of Molecular Engineering)
Photofunctional Single-Walled Carbon Nanotubes	1	Basic chemical properties of single-walled carbon nanotubes are introduced, and then applications of them as photofunctional molecular platform and charge transport pathway are presented. (T. Umeyama: Dept. of Molecular Engineering)
Renewable energies and rechargeable batteries	1	For the effective use of renewable energies,rechargeable batteries have been focused. Basic chemistry of batteries and how the rechargeable batteries are utilized for the storage of the energies will be given by the first lecture.(T. Abe: Energy and Hydrocarbon Chemistry)
Renewable energies and hydrogen production	1	Fuel cells using hydrogen are clean energy sources. The second lecture is about the hydrogen production based on the renewable energies.(T. Abe: Energy and Hydrocarbon Chemistry)
Genome sequences, what do they say and how can we use them?	1	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.(H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Optical clocks -measurement of time at the 18th decimal place	1	Time or frequency is the most precisely measurable quantity. Clocks referenced to atomic resonances, called atomic clocks, have extremely small uncertainties. They realize the definition of second and are applied to the global positioning system (GPS). This lecture introduces atomic clocks based on lasers, which improve the uncertainty to be the 18th decimal place.(K. Sugiyama: Dept. of Electronic Science and Engineering)
Mechanism of particle electrification	1	The basic concepts and theories of charge transfer between solid surfaces are summarized and particle electrification caused by repeated impacts on a wall is formulated.(S. Matsusaka: Dept. of Chemical Engineering)
Control of electrostatic charge on particles	1	On the basis of the concepts and formulation on particle electrification, new methods for the control of electrostatic charge on particles are presented.(S. Matsusaka: Dept. of Chemical Engineering)

【Textbook】None
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】Students who take Autumn term should register Lecture code 10H006.

10G001

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 (four home works will be assigned) 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
Linear system	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	2	Interpolation and its errors
Numerical integraｌ	2	Numerical integration methods
Normal differential equation and numerical integral	1	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 distributed through the course website.

【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 LibreOffice (OpenOffice).

【Web Sites】Lecture notes, home works, and other info will be distributed through PandA:
https://panda.ecs.kyoto-u.ac.jp

【Additional Information】Have a PC with Microsoft Excel with VBA or LibreOffice (https://ja.libreoffice.org/). Apache OpenOffice(http://www.openoffice.org/ja/) wil be also ok.

10G003

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】H. Hirakata

【Course Description】This course provides fundamental concepts of solid mechanics such as stress, strain, and constitutive laws, and methods for analyzing stress/strain fields and deformation of solids and structures on the basis of the concepts. In particular, the course lectures theories of nonlinear problems such as plasticity and creep, and their numerical solutions, or finite element methods, which are important for design and development of mechanical structures.

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

【Course Goals】Students will be able to:
understand solid mechanics deeply and acquire basic knowledge to design mechanical structures.
analyze problems of plasticity and creep by finite element methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Overview of solid mechanics
Stress	1	Cauchy stress tensor, Equilibrium equation, Invariants
Deformation	2	Material description and spatial description, Displacement, Deformation gradient, Lagrange-Green strain and Euler-Almansi strain, Infinitesimal strain, Material time derivative
Constitutive equation: linear elasticity	1	Linear elastic stress-strain response, Hooke’s law
Principle of virtual work and principle of minimum potential energy	1	Principle of virtual work, Principle of minimum potential energy
Finite element method for linear elasticity	3	Basis of finite element method, Finite element equilibrium equations, Elements, Numerical integration
Plasticity problems	3	Plasticity theory (uniaxial and multiaxial problems, yield criteria, flow rule, hardening rule, constitutive equations), Finite element method for elasto-plastic problems
Creep problems	2	Creep theory (uniaxial and multiaxial constitutive equations), Finite element method for creep problems
Summary	1	Discussions and reports

【Textbook】Lecture materials are distributed in the classroom.

【Textbook(supplemental)】T. Kyoya, Continuum Mechanics, Morikita (2008) (in Japanese)
Y. Tomita, “Foundation and Application of Elastoplasticity” Morikita (1995) (in Japanese)
E. Neto et al., “Computational Methods for Plasticity,” John Wiley & Sons (2008).

【Prerequisite(s)】This course requires basic knowledge of mechanics of materials and solid mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G005

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 enviroinments 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】(2017)
Matsumoto: April 10 ~ May 29
Yoshida: June 5 ~ July 10

10G007

Introduction to Advanced Fluid Dynamics
基盤流体力学

【Code】10G007 【Course Year】Master Course 【Term】1st term 【Class day & Period】Fri 1st

【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】

10G009

Quantum Condensed Matter Physics
量子物性物理学

【Code】10G009 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10G011

Design and Manufacturing Engineering

設計生産論

【Code】10G011 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10G013

Dynamic Systems Control Theory

動的システム制御論

【Code】10G013 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10G057

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.Bussiness 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

10H002

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】Department of Chemical Engineering, Professor, 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	3	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】This is an biennial course which will be open in 2016, 2018, 2020, ...

10H003

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】Department of Chemical Engineering, Professor, 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	3	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】

10C076

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, Sadayoshi Murakami,

【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)】Fundamental fluid dynamics and electromagnetics should be learned prior to attend this lecture.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10F003

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	- Outline of Structural Analysis - Mathematical Preliminaries(Vectors and Tensors)
Matrices and tensors	1	- Summation Convention - Eigenvalues and Eigenvectors
differential and integral calculus of tensors	1	- Quotient Laws - Divergence Theorem
Kinematics	1	- Material Description - Spatial Description - Material derivative
Deformation and strain	2	- Strain tensors - Compatibility conditions
Stress and equilibrium equation	1	- Stress Tensors - Equilbrium Equations
Conservation law and governing equation	1	- Conservation of Mass - Conservation of Linear Momentum - Conservation of Energy
Constitutive equation of idealized material	1	- Perfect Fluid - Linear Elastic Material(Isotropic)
Elastic-plastic behavior and constitutive equation of construction materials	1	- Yield Criteria - Flow Rule - Hardening Rule
Boundary value problem	1	- Governing Equations and Unknowns - Navier-Stokes Equation - Navier Equation
Variational principle	1	- Principle of Virtual Work - Principle of Complementary Virtual Work
Various kinds of numerical analyses	2	- Weighted Residual Method - Finite Element Method
Confirmation of the attainment level of learning	1	Feedback based on the Final Examination

【Textbook】
【Textbook(supplemental)】
【Prerequisite(s)】Basic knowledge for structural mechanics, soil mechanics and fluid mechanics are required.
【Independent Study Outside of Class】As appropriate, the assignments are given based on the content of Lecture.
【Web Sites】
【Additional Information】

10F067

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 restring forces are taken into account. Wind-induced vibration of a square prism (Galloping) 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

10F227

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 aquire 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.

10C621

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】 【Location】A1-001

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

【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. The classes will be held on Wednesday or Thursday. Schedule is 4/13,20,27 [Hikihara], 5/11,18,25 [Azuma], 6/1,6/8 [Hikihara], 6/16,6/23,30, 7/7,14 (Thursday)[Doi], 7/21 [extra].

10C601

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】

【Instructor】S. Doi & T. Hikihara

【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
Introduction 1	1	Several examples of linear operators encountered in electrical engineering, e.g. in quantum mechanics are explained. Then, Linear vector space is reviewed and linear dynamical system is introduced.
Fundamentals of linear vector space	2-4	Direct sum decomposition, projection operator, and the structure of vector spaces such as Jordan normal form are explained.
Linear dynamical system	3-5	On the basis of the knowledge of the vector space, linear dynamical systems theory is explained as a simple application of vector spaces.
Introduction 2	1	The introduction to nonlinear dynamics will be explained based on oscillation theory.
Hamiltonian mechanics	1-3	Hamiltonian mechanics is lectured on linear symplectic space.
Manifold and vector field	2-4	Manifold is discussed in nonlinear system with relation to vector filed 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. Thursday 1st class hour is due from April 13th.

10C612

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】

【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】

10G017

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 mechnics 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
farcture 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 physicall small crack Growth of microstrucually small crack
Smakk crack and cavity in creep	1	Cavity growth by diffusion creep Difference of stress filed 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】

10G041

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】

10B418

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 phsyical 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.

10G230

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	1	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	3	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. 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.

10B622

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, patern 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)】will be listed in the class.

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

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G039

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】

10G021

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】

10B628

Physics of Neutron Scattering
中性子物理工学

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

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

【Language】Japanese 【Instructor】K. Mori, Y. Onodera

【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】

10B631

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 & Period】Fri 3rd

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

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

【Course Description】 Selection, fabrication and deterioration of materials are important factors for mechanical system design. It is necessary to understand conditions under which selected materials are actually used. In particular, special design policies are required for the materials used under irradiation of high-energy particles and radiation. On the other hand, it is possible to intentionally make use of property changes of materials by high-energy particle irradiation.

Irradiation of high-energy particles such as accelerated neutrons, ions and electrons deposits very high energies at local regions. Such irradiated regions undergo extreme conditions which cannot be realized by other methods. As a result, the irradiation leads to significant structural and stoichiometric changes in materials. This lecture gives general description of materials irradiation effects, irradiation effects on materials related to nuclear power plants, and academic/industrial applications of materials fabrication/analysis by using high-energy particles.

【Grading】Grading is based on small quizzes and report submission (if necessary) on the lecture.

【Course Goals】To understand reactions and property changes of materials under radiation and high-energy particle irradiation.

【Course Topics】

Theme	Class number of times	Description
	15	(1) Introduction (2) Scattering of high-energy particles with atoms in solids (3) Displacement of atoms in solids by high-energy particles (4) Motion and behaviors of point defects (5) Rate equation of point defects and secondary-defect formation (6) The influence of irradiation on material properties (7) Activation of materials (8) High-energy particle sources (9) Ion beam fabrication (10) Ion beam analysis (11) Electron beam applications (12) Materials irradiation studies (13) Neutron irradiation effects and nuclear materials (14) Positron analysis

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge on materials engineering and mechanics

【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 & 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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B407

Robotics
ロボティクス

【Code】10B407 【Course Year】Master Course 【Term】2nd term 【Class day & 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 & Period】Wed 3rd

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

【Language】Japanese 【Instructor】Masaharu Komori

【Course Description】For any machines, prime movers and powertrains are necessary to realize the required functions. In automobiles, an engine is the prime mover and a transmission, a clutch, and a shaft are parts of the powertrain. In machine tools, a motor is used as the prime mover and the powertrain uses feed screws. In this lecture, the prime mover is taken up. Types, characteristics, principles, advantages and disadvantages of the prime mover are explained. In addition, examples of the powertrains are shown using mechanism models.

【Grading】Evaluate comprehensively by participation in class, tests, reports, etc.

【Course Goals】Understand the principles and basic characteristics of the prime movers and powertrains taken up in the lecture.

【Course Topics】

Theme	Class number of times	Description
Outline	1	Outline of mechanical functional device engineering, composition of mechanical device, examples of prime movers, working parts, and powertrains, examples of actuators and mechanisms
Electromagnetic force	3	Principle used for actuators, type of electromagnetic motor, principle and characteristics of synchronous motor, generating method of rotating magnetic field, induction motor, reluctance motor, DC motor, stepping motor
Electrostatic force	1	Usage as actuator, explanation of principle and characteristics
Piezoelectric	1	Piezoelectric effect, characteristics of piezoelectric effect, piezoelectric material, polarization, displacement and force, hysteresis, type and basic structure, application
Fluid pressure	1	Fluid pressure actuator
Ultrasonic	1	Ultrasonic motor
Shape memory alloy	1	Shape memory effect, shape resilience
Mechanism	5	Introduction of mechanism using mechanism model
Feedback class	1	Answer questions

【Textbook】Instruct as necessary.

【Textbook(supplemental)】Instruct as necessary.

【Prerequisite(s)】Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Schedule of lecture may be changed according to circumstances. Supplement in English as necessary.

10Q807

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】

10B828

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+Englihs 【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】

10V003

Biomechanics

バイオメカニクス

【Code】10V003 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B440

Environmental Fluid Dynamics

環境流体力学

【Code】10B440 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10Q402

Turbulence Dynamics
乱流力学

【Code】10Q402 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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】

10G055

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 Dislocation multiplication
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】

10Q610

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 & Period】Tue 5th 【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture + Exercise 【Language】Japanese and English

【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)	6	- 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)	1	- MD simulation of biomolecular systems - Recent examples
Application: Solid systems (R. Matsumoto)	1	- 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】

10V007

Neutron Science Seminor 1

中性子材料工学セミナーⅠ

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

10V008

Neutron Science Seminar II

中性子材料工学セミナーII

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

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

【Language】Japanese 【Instructor】K. Mori

【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】

10W025

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 & 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
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W027

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 & 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
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G029

Patent Seminar

特許セミナー

【Code】10G029 【Course Year】Master Course 【Term】2nd term 【Class day & 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】

10G203

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 & 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】Micro/nano fabrication processes and materials used to realize micro/nano systems are described. Topics will be photolithography, dry-etching, thin-film deposition, which includes bulk micro machining, surface micro machining and further advanced polymer processing.

【Grading】Evaluated by homework. All report must be submitted to obtain credits.

【Course Goals】To obtain fundamental knowledge about design and fabrication of micro/nano systems and to be familiar with recent fabrication technologies and micro/nano systems.

【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	
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G205

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 eveolved 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 analysys system	4	Chemical analysis system and bio-sensing device using microsytem.

【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.

10G209

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 & Period】Mon 1st

【Location】C3-Lecture Room 3 【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 & 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】

10G211

Solid State Physics 1

物性物理学 1

【Code】10G211 【Course Year】Master 1st 【Term】2nd term 【Class day & 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	
	1-2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G214

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 mesurement 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 mesurement	4	
	3	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10V201

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 Electromechical 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.
Evatuation 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 provoded 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 & Period】Intensive lecture using 3 days on Saturdays since mid-June 【Location】Katsura

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

【Instructor】,,,

【Course Description】Understand basic concepts related to clinical medicine and medical engineering. And expand the range of research by exchange each engineering knowledge and experience.

【Grading】Participate to the workshops submit a report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to medicine for engineering students	3	
Introduction to Medical Engineeri	4	
Cross-field workshop	8	

【Textbook】no

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B617

Quantum Theory of Molecular Physics

量子分子物理学特論

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

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

【Language】Japanese 【Instructor】Senami, Junior associate professor (Lecturer)

【Course Description】Basics for the application of quantum theory to molecular physics and recent progress. Main topics: analytic mechanics, relativistic quantum mechanics, quantum field theory, and path integral.

【Grading】Homework paper instructed in class

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
1. Analytic mechanics and symmetry in physics	2	Principle of least action, Equation of motion, Hamiltonian mechanics, Symmetry and conservation law in physics, Noether's theorem, Group theory
2. Classical relativistic theory	2	Invariance of the speed of light, Lorentz transformation, Relativistic form of electromagnetism, Four component vector potential
3. Relativistic quantum mechanics	4-6	Relativistic equation of motion, Nonrelativistic limit of Dirac equation, Covariance of Dirac equation, Plane wave solution for Dirac equation and negative energy, Hole theory and problem, Tani-Foldy-Wouthuysen transformation, Chrality
4. A primer of quantum field theory	2-4	Field operator, Charge conjugation, Noether's theorem, Gauge transformation and gauge symmetry, Application of quantum field theory to theoretical study of molecules and condensed matter
5. Electronic Structure Computation	2	Time evolution and propagator, Transition amplitude and path integral, Aharonov-Bohm effect, Path integral in quantum field theory
Confirmation	1	

【Textbook】

【Textbook(supplemental)】J. D. Bjorken, S. D. Drell, Relativistic Quantum Mechanics
J. J. Sakurai, Modern Quantum Mechanics, and Advanced Quantum Mechanics
R. P. Feynmann, A. R. Hibbs, Quantum Mechanics and Path Integrals

【Prerequisite(s)】Quantum Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】If English support is required, please contact the instructor by email. Then words written on a blackboard and some supplementary documents are provided in English.

10Q408

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 & 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】

10V205

Solid State Physics 2
物性物理学２

【Code】10V205 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10G423

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.

10G401

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 & 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】

10G403

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】

10G405

Propulsion Engineering, Adv.

推進工学特論

【Code】10G405 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 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
	1	
	2	
	2	
	4	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G406

Gas Dynamics, Adv.

気体力学特論

【Code】10G406 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 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
	1	
	3	
	2	
	4	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G409

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 & 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
	3	
	4	
	4	
	4	

【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 & 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】

10C430

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 2nd

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

【Instructor】Kei Senda, Sinya Aoi

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

【Grading】Evaluation depends on marks of examination (80%) and exercises (20%). Both marks should be 60% or better.

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

【Course Topics】

Theme	Class number of times	Description
Analytical Mechanics	7	1. Newton equations, 2. Lagrange equations, 3. Hamilton equations
Orbital Mechamics	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】

10V401

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 & 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】

10V412

Seminar on Gas Dynamics
気体力学セミナー

【Code】10V412 【Course Year】Doctor Course 【Term】1st term 【Class day & 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 Astronutics
航空宇宙流体力学セミナー

【Code】10V405 【Course Year】Doctor Course 【Term】1st term 【Class day & 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】

10R410

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 & Period】Mon 4th

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

【Instructor】,

【Course Description】

【Grading】Evaluation depends on marks of presentation, report, and so on.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Aerospace Systems	15	1. Reading textbooks 2. Reviewing journal papers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10R419

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 & 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】

10V407

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 & 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
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10V409

Thermal Engineering Seminar
熱工学セミナー

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

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

【Instructor】Yoshida, Iwai

【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】

10V413

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.

693517

Theory of Symbiotic Systems
統合動的システム論

【Code】693517 【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	

【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 & 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】

693513

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 & 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】

693431

Dynamical Systems,Advanced
力学系理論特論

【Code】693431 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

Mathematical Analysis,Advanced
数理解析特論

【Code】693410 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693320

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 & Period】Wed 4th

【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	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693321

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 & Period】 【Location】

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

653316

Heat Engine Systems
熱機関学

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

【Credits】2 【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	
	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 & 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	
	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】

10M226

Meteorology I

気象学Ｉ

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

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10M227

Meteorology II

気象学Ⅱ

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

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C072

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 & 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】

10C034

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 & 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】

10C038

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 & 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】

10C037

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】Handouts of the presentation will be provided in the lecture.
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10R013

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 & 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, or equivalents

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10F010

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 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-corrsion - 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】

10F009

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 quizes
【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】N/A
【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.

10W001

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 widelly 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】

10W005

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 & Period】 【Location】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W007

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 & Period】 【Location】

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

【Course Description】

【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】

10W009

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 & Period】 【Location】

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

【Course Description】

【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】

10W011

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 & Period】 【Location】

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

【Course Description】

【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】

10W013

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 & Period】 【Location】

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

【Course Description】

【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】

10W015

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 & Period】 【Location】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W019

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 & Period】 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Internship		
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W021

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 & Period】 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Internship		
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W023

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 & Period】 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Internship		
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10V025

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 & 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 resutls.

【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

10V027

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 & 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 resutls.

【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

10V029

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 & 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 resutls.

【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

10V031

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 & 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 resutls.

【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

10V033

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 & 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 resutls.

【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

10V035

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 & 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】

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 resutls.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

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

10W017

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】

10V037

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 & Period】 【Location】

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

10V039

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 & Period】 【Location】

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

10H403

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】Master and Doctor Course 【Term】Autumn 【Class day & Period】Thu 1st

【Location】A2-302 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Koji OTSUKA, Shunsaku KIMURA, Kiyotaka MIURA, Hiroshi KAGEYAMA, Takeshi ABE, Koichi EGUCHI, Yasujiro MURATA, Hajime TAMON, Shinji HASEBE, Kazuhiro MAE, Shuji MATSUSAKA

【Course Description】This course focuses on the latest nano- and micro- technology on reaction mechanism, particle synthesis, structure control for solid catalyst, and reaction, separation, and analysis using nano- or micrometer sized devices.

【Grading】Grades will be based on reports.

【Course Goals】The goals of this course are to understand reaction mechanism and material transfer mechanism in nanoscale and to obtain ability to apply to practical reaction systems.

【Course Topics】

Theme	Class number of times	Description
1	1	New nanocarbon chemistry (Miura)
2	1	Hierarchical control of morphology and nanostructure of porous materials synthesized by sol-gel method (Tamon)
3	1	Analytical separations in micro-nano fields (Otsuka)
4	1	Intercalation chemistry of graphite (Abe)
5	1	Precise production of nano-particles using microreactor technology (Mae)
6	1	Femtosecond laser induced micro/nano structures and their applications (Miura)
7	1	Dimensional control in magnetic materials (Kageyama)
8	1	Monitoring and control of micro-chemical plants (Hasebe)
9	1	Dimension and morphology control of molecular assemblies (Kimura)
10	1	Design of active nanostructures for solid catalysts (Eguchi)
11	1	Control of particle motion in gases (Matsusaka)

【Textbook】Handouts will be given in each lesson.

【Textbook(supplemental)】Information will be given in each lesson.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This course will be offered every two years; Not offered in 2017.

10H404

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.Akiyoshi,H.Ohkita,Y.Tsujii,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 assigments.
【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).
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 included (Tsuji).
Potentials of conjugated molecules and polymers as electronic materials	2	Conjugated molecular aggregates and conjugated polymer backbones: as motifs of electronic conductive media, their structural modulation is discussed quantitatively in terms of charge carrier mobility probed by recent sophisticated techniques of combined electro-magnetic waves spectroscopies (Seki).
Molecular function and device function relating to organic light-emitting diodes (OLEDs)	2	Recently, organic materials have been frequently used for various organic devices. Among them, OLEDs are most advanced organic devices. This lecture focuses on molecular design of excellent light-emitting organic materials and the device applications. (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) (Sato).

【Textbook】None
【Textbook(supplemental)】J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.
【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 was changed from every two years to every year in 2015. Prof. Imahori has been a head of this course since 2009.

10H407

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 & 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	

【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 reseach fields, chemistry and biologi are being closely related each other. In this class,progress in such interdisciplinary areas and topics including natural products, biophysics, bioimaging , baimaterials, regenerative medicine, microbiology, thermal biology, strucural biology, chemical biology, molecular physiology and others, are briefly explained and discussed.

【Grading】Evaluation will be conducted by attendance and scores for excercises 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 indicvidual researchers and engineers.

【Course Topics】

Theme	Class number of times	Description
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】2nd term 【Class day & Period】Thu 2nd

【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	
	3回	
	3回	
	3回	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H418

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】intesive course 【Location】A2-303 【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 microreactorsspace 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 feaxtures 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 Oxiranyllthiums: 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 Alkoxycarbonyl 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】

10H420

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】A2-307 【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
Associate Professor Taisuke Maki, Department of Chemical Engineering
Assistant Professor Yosuke Muranaka, 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
Waht is microreactor?	1	Preliminary exercises (for understanding students' knowledge level of chemical engineerinh). Explain merits and utilization concepts of microreactor with illustrating typical microreactor structure.
Trasport 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 micr omixer with illustrating various micro mixers. Next, introduce the concept of micro mixing of immiscible fluids (liwuid/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 enguneering, 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】The class is opened in 2019, and opened every other year.

10H817

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】

10H421

Design of Green Chemical Processing

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【Code】10H421 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st

【Location】A2-306 【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H424

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 & 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】

10H459

Experimental Integrated Chemical Systems

集積化学システム

【Code】10H459 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day & 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】

10W432

Laboratory and Exercise on Materials Engineering and Chemistry I

物質機能・変換科学特別実験及演習 I

【Code】10W432 【Course Year】Master 1st 【Term】1st term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W433

Laboratory and Exercise on Materials Engineering and Chemistry ⅠⅠ

物質機能・変換科学特別実験及演習Ⅱ

【Code】10W433 【Course Year】Master 1st 【Term】2nd term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W434

Laboratory and Exercise on Materials Engineering and Chemistry III

物質機能・変換科学特別実験及演習III

【Code】10W434 【Course Year】Master 2nd 【Term】1st term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W435

Laboratory and Exercise on Materials Engineering and Chemistry IV
物質機能・変換科学特別実験及演習IV

【Code】10W435 【Course Year】Master 2nd 【Term】2nd term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W437

Advanced Seminar on Materials Engineering and Chemistry I

物質機能・変換科学特別セミナーⅠ

【Code】10W437 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W438

Advanced Seminar on Materials Engineering and Chemistry II
物質機能・変換科学特別セミナーⅡ

【Code】10W438 【Course Year】Doctor Course 【Term】2nd term 【Class day & 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
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W439

Advanced Seminar on Materials Engineering and Chemistry III
物質機能・変換科学特別セミナーIII

【Code】10W439 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W440

Advanced Seminar on Materials Engineering and Chemistry IV

物質機能・変換科学特別セミナーIV

【Code】10W440 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W441

Advanced Seminar on Materials Engineering and Chemistry V
物質機能・変換科学特別セミナーＶ

【Code】10W441 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W442

Advanced Seminar on Materials Engineering and Chemistry VI

物質機能・変換科学特別セミナーVI

【Code】10W442 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】【Location】【Credits】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H009

Chemical Reaction Engineering, Adv.（English lecture）

Chemical Reaction Engineering, Adv.

【Code】10H009 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 3rd 【Location】A2-302 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】English

【Instructor】Prof. Motoaki Kawase, Department of Chemical Engineering; Assoc. Prof. Hiroyuki Nakagawa, Department of Chemical Engineering; Junior Assoc. Prof. Ryuichi Ashida, Department of Chemical Engineering

【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】

Theme	Class number of times	Description
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】

10H003

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】Department of Chemical Engineering, Professor, 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	3	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】

10H444

Mathematics and Numerical Computing

Mathematics and Numerical Computing

【Code】10H444 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】

【Location】A2-306 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Seminar and Exercise

【Language】English

【Instructor】Department of Chemical Engineering, Prof. Ohshima (representative) and Department Staffs who are experts of numerical simulations.

【Course Description】This class offers an introductory course of numerical computing with MATLAB, which is a world widely renowned scientific computing software. We want the students learn how to make a program code through several numerical calculation examples in chemistry and chemical engineering. At the last, the students are encouraged to use the MATLAB for solving the numerical problem that each students have in their thesis researches.

【Grading】Attendance and Project Reports

【Course Goals】The aim of this course is to understand the MATLAB programming code and to make a own code for a simple numerical computing problems. Through exercising the programming, basic concept of several numerical computing scheme, such as Newton method, Euler, RKG, Finite Difference, etc., will be taught.

【Course Topics】

Theme	Class number of times	Description
Introduction of Matlab	1	Learn how to Get started. Learn the Basic Manipulation of matrix and vectors. Understanding of m-files and How to write if and for statements with Matlab.
Solve Algebraic Equations	2	Learn how to solve several Linear and Nonlinear Algebraic Equations. Some calculation methods, like Newton, Scant methods are reviewed. Equation of State, Flash Calculation, Hydrogen for Fuel Cell, Equilibrium Reaction are used for example problems for computing.
Solve Ordinery Differential Equations	3	Learn how to solve ordinary differential equations. Class starts withe single equation to multiple multi-variable differential equation. Euler and RKG methods are introduced as the typical numerical calculation schemes. Plug flow reactor, batch reactor design and simulations are considered as examples of numerical calculation.
Introduce and Discuss own Numerical Computing Research Topics	1	Students are requested to make a presentation on their research topics that can have any numerical computing issues. Discuss whether Matlab can be applicable for solving the issues.
Data Analysis	2	Learn how to deal with big experimental data and extract the information. Least square method and FFT are introduced. Near Infrared Spectral or Plant data will be provided to analyze with the Matlab coded by themselves.
Solve Partial Differential Equations	2	Learn how to solve a typical parabolic differential equation. Learn Finite difference (Explicit and Implicit schemes. Heat conduction and flow in tube are execized.

【Textbook】Handout from tutors

【Textbook(supplemental)】Informed accordingly

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】The class is not opened in 2019, and opened every other year.

10H446

English for Debate and Communications

English for Debate and Communications

【Code】10H446 【Course Year】Master and Doctor Course 【Term】2nd term

【Class day & Period】6 weeks of intensive classes (practice) 4 hours per one week

【Location】A3 -025 Seminar Room 【Credits】1.5

【Restriction】Maximum number of students accepted for the class is 8 【Lecture Form(s)】Seminar and Exercise

【Language】English

【Instructor】 Dr. Mike Sullivan, Lingauge Intercom Corporation Dept of Chemical Engineering, Prof. M. Ohshima

【Course Description】The course is built up with 6 units. Through these six units one by one, the students can learn how to give, explain, organize their own opinion and conduct the debate.

【Grading】Attendance and performance in the class

【Course Goals】Learn the basic and key phrases of active listening, interrupting, clarifying and confirming, paraphrasing, hesitating, and showing your understanding. After discussion and simulation of debating, debate is conducted for given questions.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Giving Your Opinion	2	Discussion Focus/ Key points Language Focus 1; Active Listening, Hesitating Practice Language Focus 2: Opinions/suggestion Putting them together. Discussion and Simulations. Debate Question of the Week 1
Unit 2: Explaining Your Opinion	2	Discussion Focus/ Key points Topic Sentence, Primary Sentence, Debatable/No-debatable Practice Primary Supporting Sentence Practice Connecting Words & Practice Discussion and Simulation. Debate Question of the Week 2
Unit 3: Organizing Your Opinion	2	Discussion Focus/ Key points Secondary Supporting Sentence Developing and Argument Practice Putting them together. Discussion and Simulations. Debate Question of the Week 3
Unit 4: Interrupting/Refuting Opinions	2	Discussion Focus/ Key points Interrupting, Interrupting Practice Refuting Opinions, Refutation Practice Discussion and Simulations. Debate Question of the Week 4
Unit 5:Challenging Support	2	Discussion Focus/ Key points Persuading Language, Making Proposals Practice Speaking Practice Challenging and Defending Language Discussion and Simulations. Debate Question of the Week 5
Unit 6: Delivery/Performance	2	Discussion Focus/ Key points Persuasive Language Delivery Focus: Word/Sentence Stress. Intonation Discussion and Simulations. Debate Question of the Week 6

【Textbook】a in-house booklet be provided

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H431

Molecular Porous Physical Chemistry

Molecular Porous Physical Chemistry

【Code】10H431 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】A2-304 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】（物）教授・Easan Sivaniah

【Course Description】This course will discuss the physical chemistry and engineering application of porous materials in the areas of adsorption and membrane separation processes.

【Grading】The course grade will be determined based on in class tests and a final report.

【Course Goals】The intention of this course is to allow students to become familiar with a range of porous materials, and the practical ways such materials are used. Although the course is not intended to be exhaustive in covering all porous materials and all applications, examples will be followed that are relevant to socially important problems, such as global warming, or water shortage.

【Course Topics】

Theme	Class number of times	Description
Overview	1	Introduction to course, and broad overview of porous materials
Thermodynamics of Mixing	2	Phase equilibria and structure formation processes
Adsorptive processes	2	Physical chemistry of adsorptive processes in porous materials
Diffusive processes	2	Physical chemistry of diffusion limited processes in porous materials
Case Study: Membrane Processes for liquid separation	2	Liquid filtration systems for nanofiltration, desalination
Case Study: Membrane Processes for gas separation	2	Case Study: Membrane Processes for gas separation

【Textbook】

【Textbook(supplemental)】Suggested text book lists will be provided during the course

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】http://pureosity.org/en/

【Additional Information】

10P448

Japan Gateway Project Seminar Ⅰ

JGP セミナーⅠ

【Code】10P448 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅱ

JGP セミナーⅡ

【Code】10P450 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅲ

JGP セミナーⅢ

【Code】10P452 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅳ

JGP セミナーⅣ

【Code】10P454 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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.

10P456

Japan Gateway Project Seminar Ⅴ

JGP セミナーⅤ

【Code】10P456 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅵ

JGP セミナーⅥ

【Code】10P457 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & 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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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.

10P459

Japan Gateway Project Seminar Ⅶ

JGP セミナーⅦ

【Code】10P459 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅷ

JGP セミナーⅧ

【Code】10P461 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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 Ⅸ

JGP セミナーⅨ

【Code】10P463 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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.

10P465

Japan Gateway Project Seminar Ⅹ

JGP セミナーⅩ

【Code】10P465 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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.

10P467

Japan Gateway Project Seminar ?

JGP セミナーＸＩ

【Code】10P467 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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ⅩⅡ

【Code】10P469 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Announced before opening the course 【Location】Announced before opening the course

【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】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
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】A copy of related contents is offered.

【Textbook(supplemental)】Announced in the lecture.

【Prerequisite(s)】The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【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.

10H470

JGP International Internship I

JGP 国際インターンシップ Ｉ（短期）

【Code】10H470 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day & Period】Flexible

【Location】Overseas cooperation university in JGP project 【Credits】1

【Restriction】Limited to the students in Top Global Course 【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members of Chemistry and Chemical Engineering Unit for the Top Global Course, Professors of overseas cooperation universities in JGP project

【Course Description】At the overseas cooperation university in Kyoto University Top Global Program, 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 student in internship is requested to submit internship plan before the internship, some progress reports during the internship and the final report at the end of the internship. The seminar presentation is also requested after finishing the internship. The grading is conducted based on the period and the performance of 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
International Internship	20	At the overseas cooperation university in Kyoto University Top Global Program, a research-based internship of one month is executed.
Seminar	1	The contents of the internship is reported at the seminar.

【Textbook】None

【Textbook(supplemental)】None

【Prerequisite(s)】Careful plan of internship should be prepared under the supervision of Japanese supervisor. Enough English ability for discussing with the foreign supervisor during the internship is requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】By the limitation of budget for each year, the number of students will be restricted.

10H471

JGP International Internship II

JGP 国際インターンシップ II（中期）

【Code】10H471 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day & Period】Flexible

【Location】Overseas cooperation university in JGP project 【Credits】2

【Restriction】Limited to the students in Top Global Course 【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members of Chemistry and Chemical Engineering Unit for the Top Global Course, Professors of overseas cooperation universities in JGP project

【Course Description】At the overseas cooperation university in Kyoto University Top Global Program, a research-based internship of two month is executed. Through the internship, study how to proceed the research at the advanced universities, and improve the English communication ability.

【Grading】The student in internship is requested to submit internship plan before the internship, some progress reports during the internship and the final report at the end of the internship. The seminar presentation is also requested after finishing the internship. The grading is conducted based on the period and the performance of 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
International internship	40	At the overseas cooperation university in Kyoto University Top Global Program, a research-based internship of two month is executed.
Seminar	1	The contents of the internship is reported at the seminar.

【Textbook】None

【Textbook(supplemental)】None

【Prerequisite(s)】Careful plan of internship should be prepared under the supervision of Japanese supervisor. Enough English ability for discussing with the foreign supervisor during the internship is requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】By the limitation of budget for each year, the number of students will be restricted.

10H472

JGP International Internship III

JGP 国際インターンシップ III（長期）

【Code】10H472 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day & Period】Flexible

【Location】Overseas cooperation university in JGP project 【Credits】4

【Restriction】Limited to the students in Top Global Course 【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members of Chemistry and Chemical Engineering Unit for the Top Global Course, Professors of overseas cooperation universities in JGP project

【Course Description】At the overseas cooperation university in Kyoto University Top Global Program, a research-based internship of more than three month is executed. Through the internship, cultivate the abilities of communication with foreign researchers, management of a research, and writing research papers.

【Grading】The student in internship is requested to submit internship plan before the internship, some progress reports during the internship and the final report at the end of the internship. The seminar presentation is also requested after finishing the internship. The grading is conducted based on the period and the performance of 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
Theme Class number of times Description International internship	60	At the overseas cooperation university in Kyoto University Top Global Program, a research-based internship of more than three month is executed.
Seminar	1	The contents of the internship is reported at the seminar.

【Textbook】None

【Textbook(supplemental)】None

【Prerequisite(s)】Careful plan of internship should be prepared under the supervision of Japanese supervisor. Enough English ability for discussing with the foreign supervisor during the internship is requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】By the limitation of budget for each year, the number of students will be restricted.

10D051

Frontiers in Modern Science & Technology

現代科学技術の巨人セミナー「知のひらめき」

【Code】10D051 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Wed 5th 【Location】Funai Hall
【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
【Instructor】GL center: J.Assoc. Tanaka, Mizuno, Takatori, Matsumoto, Ashida and Related professors
【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.
【Grading】Refer material about grading this course which is provided in 1st and 2nd lectures.
【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.
【Course Topics】

Theme	Class number of times	Description
Construction of solar updraft power generation (SUPG) system on the ocean	1	Prof. Kunimasa Sugiura (Civil and Earth Resources Engineering) Apr. 12
Record and protection of world cultural heritage by advanced image processing	1	Prof. Ari Ide (Mechanical Engineering and Science) Apr. 19
Mysterious characteristics of smell: from development of smell identification device	1	Dr. Jun-ichi Kita (Shimadzu Corporation） Apr. 26
Science and engineering of metals and potential of metals	1	Prof. Nobuhiro Tsuji (Materials Science and Engineering) May 10
My days with radiation ray	1	Dr. Katsumi Hayashi (Hitachi, Corporation) May 17
Material synthesis considering feeling of molecules	1	Prof. Yasujiro Murata (Energy and Hydrocarbon Chemistry) May 24
Practical Marketing not on books	1	Dr. Fuminori Takaoka (Edge, Ltd.) May 31
Direct visualization of atoms and molecules	1	Prof. Hirofumi Yamada (Electronic Science and Engineering) Jun. 7
Encouragement for serial innovator	1	Prof. Mitsuaki Oshima (Panasonic Corporation) Jun. 14
Idle time and idle space	1	Prof. Kiyoshi Takeyama (Architecture and Architectural Engineering) Jun. 21
Research of cancer therapy by heavy ion beams	1	Dr. Koji Noda (National Institutes for Quantum and Radiological Science and Technology) Jun. 28
Seven Wonders of powders	1	Prof. Shuji Matsusaka (Chemical Engineering) Jul. 5
Strong company organizations in Japan, USA and Germany	1	Dr. Masahiko Mori (DMG MORI Co.,Ltd.) Jul. 12
Development of construction techniques: from development of advanced technique to big projects	1	Dr. Ichiro Nagashima (Taisei Corporation) Jul. 19
Manufacturing by advanced optical machining	1	Prof. Kiyotaka Miura (Material Chemistry) Jul. 26

【Textbook】Course materials will be provided.
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10i045

Exercise in Practical Scientific English Ⅰ

実践的科学英語演習Ⅰ

【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 20 students for each class 【Lecture Form(s)】Seminar 【Language】English (Japanese)

【Instructor】M. Nishikawa, Y. Tanaka, T. Mizuno, A. Takatori, R. Matsumoto, R. Ashida

【Course Description】This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding. approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】Evaluation based on 10% participation, 60% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】Handout materials will be supplied by the instructor.

【Textbook(supplemental)】ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 .（2007）.『理系英語のライティング』. アルク

【Prerequisite(s)】Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【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. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

10K001

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 5th 【Location】A2-306 【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction

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

【Instructor】GL Edu. Center, J. Assoc. Prof., Ryuichi Ashida
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】Requirements and a number of credits are different with the academic system students choose, the modified academic quarter system or the academic semester system. Students who choose the academic semester system must meet the requirements for the first 11 lectures and the latter 4 lectures separately.
When the students who choose the modified quarter system are graded, the average score of the best four reports is employed. When the students who choose the academic semester system are graded, the average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Materials Processing Using External Fields for Microstructure Control	1	Properties of materials are not simply determined by crystal structure and chemical composition. Microstructure (i.e. crystal grain size, crystallographic orientation) can significantly influence the properties. Materials processing for the microstructure control, using external fields will be demonstrated in this class. (H. Yasuda: Dept. of Materials Science and Engineering)
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. (Y. Nakao: Dept. of Material Chemistry)
Synthesis and Functions of Mixed Anion Compounds	1	As we entered the 21st century, mixed anion compounds, which contain several different anions, began to draw attention as new types of inorganic material. My lecture will show synthetic and functional aspects in this class of materials. (H. Kageyama: Dept. of Energy and Hydrocarbon Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
Photonic Crystal Technology	1	Photonic crystals are materials with periodic modulation of refractive index, in which a frequency range that existence of photon is prohibited (i.e. photonic band gap) can be formed. In this class, basics and applications of photnic crystals are introduced. (T. Asano: Dept. of Electronic Science and Engineering)
Introduction to Nuclear Materials	1	Nuclear materials are designed for irradiation field of neutron and high-energy particles. Some topics of nuclear transmutation, thermonuclear fusion, boron neutron capture therapy and others will be talked. (I. Takagi: Dept. of Nuclear Engineering)
Application of Polymer Nanoparticles to Bio-Imaging	1	Polymers are widely used in various delivery/localization events as drug carriers, stabilizers of clinical protein and nucleic acid medications, and lesion targeters. An obvious merit of polymers with an appropriate (>10 nm) size is that they escape from facile renal excretion. The size has another significance in case of tumor targeting. Tumor tissues usually have defective endothelial cells with a wide opening and undeveloped lymphatic vessel, so that polymer nanoparticles of the size range of 10 － 100 nm can permeate into the tumor and are retained therein. This is the so-called enhanced permeability and retention (EPR) effect, which shows high performance in terms of selectivity and efficiency in bio-imaging. (T. Kondo: Dept. of Energy and Hydrocarbon Chemistry)
Radiation Induced Reactions towards 1 -Dimensional Nanomaterials	1	Whether can we produce nano-material by the reactions induced by a “ ray ” (ionizing radiation)? The answer is yes. With an use of an atomic particle accelerated up to MeV orders, the one particle provides a nanowire along its trajectory via condensed and efficient chemical reactions in organic media. Single particle Nanofabrication Technique (SPNT) or Single Particle Triggered Linear Polymerization (STLiP), referred as, are demonstrated as versatile methods to give low dimensional nanomaterials based on a variety of organic molecular systems in this lecture. (S. Seki: Dept. of Molecular Engineering)
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. (K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
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. (H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Designing Polymer Membrane Materials to Capture Green House Gases	1	We will discuss the overall obstacles involved in capturing green house gases such as CO2 or Methane, and the specific challenges to generating polymer membranes that can achieve it. Then we will consider how to design polymer materials that can overcome such obstacles. (E. Sivaniahi: Dept. of Molecular Engineering)
Oxide Magnetic Materials	1	The aim of the lecture is to review the fundamentals and applications of oxide magnetic materials. Main topics include fundamentals of magnetism, magnetic properties of oxides, magneto-optics of oxides, oxides for spintronics, and multiferroic oxides. (K. Tanaka: Dept. of Material Chemistry)
Force Acting on Colloidal Particles	1	Colloid means small particles dispersed in a liquid solvent. Theoretical approaches on several forces acting on colloidal particles such as thermal, hydrodynamic, and electrostatic forces will be discussed. (R. Yamamoto: Dept. of Chemical Engineering)
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. (K. Murase: Dept. of Materials Science and Engineering)

【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.

10K005

Advanced Modern Science and Technology（English lecture）

現代科学技術特論 (英語科目)

【Code】10K005 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system) 【Restriction】No Restriction
【Lecture Form(s)】Relay Lecture 【Language】English
【Instructor】 GL Edu. Center, J. Assoc. Prof., Ryosuke Matsumoto
Related professors
【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】Students who choose the academic semester system must meet the requirements for the first 11 lecturers and the latter 4 lecturers separately.
When evaluating your grade, I employ the average score of best four reports for students who chose the modified quarter system, and best five reports for students who chose academic semester system.
Please go to KULASIS Web site. You can find an attachment file, ”通知版：2016 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
Exploration of Radiation Belts by Space Radio Engineering	1	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.(Y. Omura: Dept. of Electrical Engineering)
Functional Organic Molecular Materials for Molecular Scale Nanoscience	1	This lecture explains functional organic molecular materials with functions like photochromism or molecular conductance, which are expected to play an active role in molecular scale nanoscience.(K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
Micro- and Nano-scale Separations in Analytical Chemistry	1	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.(K. Otsuka: Dept. of Material Chemistry)
Role of Nanoparticles Aiming at Theranostic Agents for Solid Cancers － Sustainable Universe Health Care in the Aged Society	1	Malignancy takes the first position for the cause of mortality in Japan. Realization of a “ society of health and longevity ” therefore requires a general method for diagnosis and therapy for cancers in the early stage. Nanoparticles are currently highly expected to this type of medicinal treatment, because nanoparticles can avoid expensive therapy, which would bankrupt our universal health care system.(S. Kimura: Dept. of Material Chemistry)
What are polymers?	1	What is a polymer? Also, what is the difference between polymers and other molecules? The characteristics of polymers and polymerizations are explained with some examples on practical applications of polymers.(M. Ouchi: Dept. of Polymer Chemistry)
Precision Polymerization and Functional Materials by Macromolecular Design	1	The methodology to synthesize polymers precisely and their features are described. In addition, some examples on functional materials using polymers whose molecular design is important are introduced.(M. Ouchi: Dept. of Polymer Chemistry)
Analysis and Design of Socio-Technical Systems	1	When introducing various kinds of automation systems including robots into a new work environment, it is necessary to design and analyze from the viewpoint of socio-technical systems, which is the interaction system of people, technology and organization. In this lecture, specific problems and solutions are described.(T. Sawaragi: Dept. of Mechanical Engineering and Science)
Computational Chemistry and computer science	1	Remarkable progress in the computer science has been revolutionizing scientific research and technological development for this decade. This trend will further accelerate in the future. This lecture reviews the impact of state of the art computer science on the molecular chemistry as an example.(R. Fukuda: Dept. of Molecular Engineering)
Photofunctional Single-Walled Carbon Nanotubes	1	Basic chemical properties of single-walled carbon nanotubes are introduced, and then applications of them as photofunctional molecular platform and charge transport pathway are presented. (T. Umeyama: Dept. of Molecular Engineering)
Renewable energies and rechargeable batteries	1	For the effective use of renewable energies,rechargeable batteries have been focused. Basic chemistry of batteries and how the rechargeable batteries are utilized for the storage of the energies will be given by the first lecture.(T. Abe: Energy and Hydrocarbon Chemistry)
Renewable energies and hydrogen production	1	Fuel cells using hydrogen are clean energy sources. The second lecture is about the hydrogen production based on the renewable energies.(T. Abe: Energy and Hydrocarbon Chemistry)
Genome sequences, what do they say and how can we use them?	1	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.(H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Optical clocks -measurement of time at the 18th decimal place	1	Time or frequency is the most precisely measurable quantity. Clocks referenced to atomic resonances, called atomic clocks, have extremely small uncertainties. They realize the definition of second and are applied to the global positioning system (GPS). This lecture introduces atomic clocks based on lasers, which improve the uncertainty to be the 18th decimal place.(K. Sugiyama: Dept. of Electronic Science and Engineering)
Mechanism of particle electrification	1	The basic concepts and theories of charge transfer between solid surfaces are summarized and particle electrification caused by repeated impacts on a wall is formulated.(S. Matsusaka: Dept. of Chemical Engineering)
Control of electrostatic charge on particles	1	On the basis of the concepts and formulation on particle electrification, new methods for the control of electrostatic charge on particles are presented.(S. Matsusaka: Dept. of Chemical Engineering)

【Textbook】None
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】Students who take Autumn term should register Lecture code 10H006.

10i012

Business Japanease Ⅱ A

ビジネス日本語講座Ⅱ A

【Code】10i012 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 2nd

【Location】B-Cluster 2F Seminar Room 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Institute for Liberal Arts and Sciences, Part-time Lecturer, Miho Kadonaga

【Course Description】This course aims to develop Japanese language abilities applicable in business situations for advanced Japanese learners who are interested in working for Japanese companies or Japanese-affiliated companies.

【Grading】Evaluation will be based on homework 20%, contribution to the class 30%, and class participation (including manners) 50%.

【Course Goals】・To learn basic business styles useful in job hunting.
・To learn vocabulary and honorific expressions used in business.
・To deepen your knowledge about Japanese companies.
・To learn about the cultural background and the way of thinking underlying the language.

【Course Topics】

Theme	Class number of times	Description
Information I	1	international student employment trends in Japan
Self-introduction	2	your strengths in college, strong and weak points
Information II	1	researching and learning about the business world and companies
Writing application forms, addressing envelope	2	writing entry sheets, CVs, cover letters
Writing effective e-mails	2	making inquiries, scheduling interviews, etc.
Telephone conversations	2	making inquiries, scheduling interviews, etc.
Information III	1	researching and learning about the business world and companies
Preparing for interviews	2	roup interviews, individual interviews, group discussions, personal appearance
Information Ⅳ	1	written tests, job fairs, joint company information sessions
Review	1	review

【Textbook】

【Textbook(supplemental)】Advice on how to prepare for written tests will be given in class as needed.

【Prerequisite(s)】Advanced level Japanese ability or the equivalent (equivalent to the JLPT N1 or N2 levels)

【Independent Study Outside of Class】Students are expected to apply the skills and knowledge gained to their job-hunting activities.

【Web Sites】

【Additional Information】

10i013

Business Japanease Ⅱ B

ビジネス日本語講座Ⅱ B

【Code】10i013 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 2nd

【Location】B-Cluster 2F Seminar Room 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Institute for Liberal Arts and Sciences, Part-time Lecturer, Miho Kadonaga

【Course Description】This course aims to develop Japanese language abilities applicable in business situations for advanced Japanese learners who are interested in working for Japanese companies or Japanese-affiliated companies.

【Grading】Evaluation will be based on homework 20%, contribution to the class 30%, and class participation (including manners) 50%.

【Course Goals】・To learn basic business styles useful in Japanese companies.
・To learn vocabulary and honorific expressions used in business.
・To deepen your knowledge about Japanese companies.
・To learn about the cultural background and the way of thinking underlying the language.

【Course Topics】

Theme	Class number of times	Description
Information I	1	Utilization of foreign employees in the Japanese companies
Japanese business phrases	2	Japanese honorific, spoken words and written words
Telephone conversations	2	making and receiving calls
Writing e-mails	3	e-mail forms within the office and outside the office
Writing	2	writing report, proposal. taking the minutes writing cover letter, request paper, etc.
Information II	1	visas and working permits Japanese social security system
Visiting companies	1	inquiring at reception, greeting, exchange business cards, etc.
Receiving visitors	1	introducing, leading the way, order of precedence, etc.
Information III	1	Japanese business custom, personnel-management system, etc.
Review	1	Review

【Textbook】

【Textbook(supplemental)】Supplementary material will will be given in class as needed.

【Prerequisite(s)】Advanced level Japanese ability or the equivalent (equivalent to the JLPT N1 or N2 levels)

【Independent Study Outside of Class】Students are expected to practice the skills and knowledge gained to their ordinary activities.

【Web Sites】

【Additional Information】

10i041

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 & Period】Thu 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)】Semina ｒ 【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.

10i042

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】2nd term 【Class day & 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&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	Course contents, goals
Cost concepts and design economics	1	Cost terminology and classification
Cost estimation techniques	1	WBS for cost estimation, estimation techniques (indexes, unit, factor, power-sizing, learning curve, CER, top down, bottom up), target costing
The time value of money	1	Simple interest, compound interest, economic equivalence concept, cash-flow diagrams, PW, FW, AW
Evaluating a single project	1	MARR, present wort method, bond value, capitalized worth, internal rate of return, external rate of return, payback method
Comparison and selection among alternatives	1	Investment and cost alternatives, study period, equal and unequal useful lives, rate-of-return method, imputed market value
Depreciation and income taxes	1	SL and DB depreciation methods, book value, after-tax MARR, marginal income tax rate, gain(loss) on asset disposal, after-tax economic analysis general procedure, EVA,
Price changes and exchange rates	1	Actual dollars, real dollars, inflation, fixed and responsive annuities, exchange rates, purchasing power
Replacement analysis	1	Determining economic life of challenger, determining economic life of defender, abandonment, after-tax replacement study
Evaluating projects with the benefit-cost ratio method	1	Benefits, costs, dis-benefits, self-liquidating projects, multi-purpose projects, interest rate vs. public project, conventional B-C ratio PW and AW method, modified B-C ratio PW and AW method
Breakeven and sensitivity analysis	1	Breakeven analysis, sensitivity analysis, spider plot
Probabilistic risk analysis	1	Sources of uncertainty, discrete and continuous variables, probability trees, Monte Carlo simulation example, decision trees, real options analysis
The capital budgeting process	1	Capital financing and allocation, equity capital and CAPM, WACC, WACC relation to MARR, opportunity cost
Decision making considering multiattributes	1	Non-compensatory models (dominance, satisficing, disjunctive resolution, lexicography), compensatory models (non-dimensional scaling, additive weight)
Final test	1	90 minutes, concept questions, calculation task (option of choice)
		Additionally, students will submit three 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 “ Project Management in Engineering" 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 Oct.3rd.

10i049

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】10i049 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 4th 【Location】A2-308 【Credits】2

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

【Instructor】GL center: J.Assoc.Prof. Takatori, Mizuno, Tanaka, Matumoto, Ashida

Assoc.Prof. Lintuluoto

【Course Description】This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】Evaluated by assignments (project report exercise) and class contribution

【Course Goals】This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course "Seminar on Project Management in Engineering." in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/14 (Ashida) Course guidance
Introduction to project management & Project phases	1	4/21 (Takatori) Introduction to project management Project phases
Tools for project management, cost, and cash flows I	1	4/28 (Lintuluoto) Tools Work breakdown structure Gantt charts
Project scheduling I	1	5/12 (Ashida) Project scheduling I
Project scheduling II	1	5/19 (Ashida) Project scheduling II
Tools for project management, cost, and cash flows II	1	5/26 (Lintuluoto) Cost
Tools for project management, cost, and cash flows III	1	6/2 (Lintuluoto) Cash flow
TBA	1	6/9 To be announced
Leadership I	1	6/16 (Tanaka) Leadership I
Leadership II	1	6/23 (Tanaka) Leadership II
Risk I	1	6/30 (Matsumoto) Risk I
Risk II	1	7/7 (Matsumoto) Risk II
Environmental Impact Assessment I	1	7/14 (Mizuno) Environmental Impact Assessment I
Environmental Impact Assessment II	1	7/21 (Mizuno) Environmental Impact Assessment II
Special lecture Project management ~Tender process of Panama Canal expansion project~	1	7/28 @ A2-306 (Cluster A, Katsura Campus) Lecturer: Taizo SHIMOMURA, Dr. (TAISEI CORPORATION)

【Textbook】Course materials will be provided.

【Textbook(supplemental)】1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】No pre-requisite

【Independent Study Outside of Class】

【Web Sites】The web-site is opened in the home page of the GL education center.

【Additional Information】

10i050

Exercise on Project Management in Engineering
エンジニアリングプロジェクトマネジメント演習

【Code】10i050 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 5th

【Location】B-Cluster 2F Seminar Room 【Credits】1 【Restriction】Student number will be limited.

【Lecture Form(s)】Seminar 【Language】English

【Instructor】GL center: J.Assoc.Prof. Mizuno, Tanaka, Matumoto, Ashida, Maeda
Assoc.Prof. Lintuluoto

【Course Description】In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering 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, presentations, and a few intermediate discussions. 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	10/6 Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】Course materials will be provided.

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】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】The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

10i009

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】1st+2nd term 【Class day & Period】Flexible

【Location】 【Credits】Depend on the department that the student belongs to 【Restriction】No Restriction

【Lecture Form(s)】Seminar and Exercise 【Language】Japanese

【Instructor】GL Education Center, Lecturer, Aiko Takatori, and related faculty members

【Course Description】This internship aims at mastering the meaning of engineering by experiencing the applied research and technical development in a company, and acquiring the flexible ability to cope with various industrial problems.

【Grading】The presentation and/or reports after the internship are used for evaluation. The rating is done at each department if this internship has been authorized at the department. If not, the rating is done at GL Education Center, and the credit earned by this subject is treated as a redundant credit.

【Course Goals】Through the experiences of actual businesses, such as a research or operation planning, grasping the actual condition of Japanese industries and the capability that the industries are searching for.

【Course Topics】

Theme	Class number of times	Description
Internship in a company	1	The research theme is determined through the prior consultation between a program participating company and the administrator of the GL Education Center by taking the intention of students into account. After concluding the memorandum which defined the matter required for enforcement, internship activity for one month or more is executed in an acceptance company.
Presentation of the result of internship	1	Submitting a report, and presenting the result of internship.

【Textbook】Not used

【Textbook(supplemental)】Not used

【Prerequisite(s)】Prior matching is performed.

【Independent Study Outside of Class】Not requested.

【Web Sites】

【Additional Information】The internship organized by the Collaborative Education for Next-Generation Innovators & Exploration of Knowledge Intersections is also treated as the internship of this course.

10D043

Instrumental Analysis, Adv. Ⅰ

先端科学機器分析及び実習Ⅰ

【Code】10D043 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10D046

Instrumental Analysis, Adv. Ⅱ
先端科学機器分析及び実習Ⅱ

【Code】10D046 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	2	
	2	
	2	
	2	
	2	

【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 & Period】Intensive lecture using 3 days on Saturdays since mid-June 【Location】Katsura

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

【Instructor】,,,

【Course Description】Understand basic concepts related to clinical medicine and medical engineering. And expand the range of research by exchange each engineering knowledge and experience.

【Grading】Participate to the workshops submit a report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to medicine for engineering students	3	
Introduction to Medical Engineeri	4	
Cross-field workshop	8	

【Textbook】no

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C070

Introduction to Quantum Science

基礎量子科学

【Code】10C070 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10D636

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 & 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】

10V201

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 Electromechical 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.
Evatuation 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 provoded 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.

10W620

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 & 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	2	
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】

10C072

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 & 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】

10G203

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 & 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】Micro/nano fabrication processes and materials used to realize micro/nano systems are described. Topics will be photolithography, dry-etching, thin-film deposition, which includes bulk micro machining, surface micro machining and further advanced polymer processing.

【Grading】Evaluated by homework. All report must be submitted to obtain credits.

【Course Goals】To obtain fundamental knowledge about design and fabrication of micro/nano systems and to be familiar with recent fabrication technologies and micro/nano systems.

【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	
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G209

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 & Period】Mon 1st

【Location】C3-Lecture Room 3 【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】

10G041

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】

10G205

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 eveolved 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 analysys system	4	Chemical analysis system and bio-sensing device using microsytem.

【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.

10C074

Quantum Science
量子科学

【Code】10C074 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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】

10C017

Radiation Physics and Engineering
放射線物理工学

【Code】10C017 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10C047

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, Hiroki Tanaka, 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 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
Introduction to medical physics for radiation	1	
Fundamental bilology for radiation	1	
Radiation measurement and evaluation	2	
Physics in radiation diagnosis	4	
Physics in radiation therapy	5	
Quality assurance and standard dosimetry	1	
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】

10C078

Hybrid Advanced Accelerator Engineering
複合加速器工学

【Code】10C078 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Yoshihiro Ishi

【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	1	
Major components of accelerators	1	
Orbit theories of the beam	3	
Theory of radio frequency acceleration	2	
Practice of accelerator designing	2	
Non linear beam dynamics and others	4	
Summary and check the accomplishment	1	

【Textbook】

【Textbook(supplemental)】S.Y.Lee, Accelerator Physics, World Scientific (1999), 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】

10W606

Diagnostic Imaging
画像診断学

【Code】10W606 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W618

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 term 【Class day & 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日	
	１日	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C068

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 & 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
	1	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C084

Nuclear Engineering, Adv.
原子核工学最前線

【Code】10C084 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10H649

Polymer Synthesis
高分子合成

【Code】10H649 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 2nd

【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
	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】

10D651

Polymer Physical Properties

高分子物性

【Code】10D651 【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, Mikihito 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】

10H645

Polymer Functional Chemistry
高分子機能化学

【Code】10H645 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10H607

Design of Polymerization Reactions

高分子生成論

【Code】10H607 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 3rd

【Location】A2-307 【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	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H610

Reactive Polymers

反応性高分子

【Code】10H610 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【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】2nd term 【Class day & Period】Thu 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】H. Ohkita

【Course Description】In this class, optoelectronic 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 applications, which include optical fibers, organic light-emitting diode, and organic solar cells.

【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	3	
Photofunctional Polymers	3	
Optoelectronic Polymers	4	

【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 chemisty course for undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H616

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,Mikihito 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 stuctures 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	3	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	3	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】

10H611

Biomacromolecular Science

生体機能高分子

【Code】10H611 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【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
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H643

Polymer Solution Science
高分子溶液学

【Code】10H643 【Course Year】Master and Doctor Course 【Term】1st 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 (10D651).

【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】Fri 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】

10H625

Polymer Spectroscopy
高分子分光学

【Code】10H625 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】ICR Seminar Room 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】K. Nishida

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Outline of Polymer Spectroscopy	2	
Basic Mathematics for Spectroscopy	2	
Neutron Spectroscopy	2	
Infrared, Raman, Brillouin Spectroscopy	3	
Photon Correlation Spectroscopy	1	
Verification of Understanding	1	

【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 & Period】Tue 2nd

【Location】(Uji campus) ICR Seminar Room 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Yoshinobu TSUJII, Kohji OHNO

【Course Description】This course aims at better understanding of fundamentals on living radical polymerization and describes its application to graft polymerization for novel surface modification as well as its related matters.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to radical polymerization	1	radical polymerization, mechanism, kinetics, elementary reaction
Fundamentals on living radical polymerization and its application to material design	2	living radical polymerization, mechanism, kinetics, functional polymer, material design
Physical chemistry on surfaces and polymer brushes	2	Surface, interface, physical chemistry, polymer brush, theory, structure, property
Living radical polymerization and polymer particles	2	Living radical polymerization, surface-initiated polymerization, polymer brush, hairy particle, star polymer
Synthesis of polymer particles by radical polymerizations	2	Emulsion polymerization, suspension polymerization, dispersion polymerization, precipitation polymerization, self-organized precipitation, nonspherical particle
Applications of polymer particles	2	Self-assembly, dispersion and aggregation, depletion force, pickering emulsion, composites, biochemical and biomedical applications

【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 & Period】Tue 4th

【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	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H633

Biomaterials Science and Engineering

高分子医工学

【Code】10H633 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H029

Polymer Physics and Function
高分子機能物性

【Code】10H029 【Course Year】Master Course 【Term】(not held; biennially) 【Class day & 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】

10H021

Engineering for Chemical Materials Processing

化学材料プロセス工学

【Code】10H021 【Course Year】Master and Doctor Course 【Term】Spring 【Class day & Period】Wed 4th 【Location】A2-302

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Dept. of Chemical Engineering, Prof. M.Ohshima

,Dept of Chemical Engineering, Associate Prof. S.Nagamine,

【Course Description】Focusing on transport phenomena (flow & rheology, mass flux, heat flux) in polymer processing process, the key relationships among polymer properties, processing schemes, and processing machine are taught.

【Grading】40% midterm quiz, 60% exam at end

【Course Goals】The objective of this course is to know how the polymers are different in terms of thermal, rheological and mechanical properties. The attendees learn what Tg, Tc, Tm, G' and G are, how those properties can be measured and how these obtained measurement data can be appreciated. Visual Observation movies relates those properties with the transport phenomena that occur in several polymer processing processes.

【Course Topics】

Theme	Class number of times	Description
Orientation & Introduction of Polymer Processing	1	The characteristics of polymers are reviewed by exercising the characterization of general polymers, like PE, PP, PLA, PC, PS, PVC in terms of appearance, thermal and mechanical properties.
State of Thermoplastic Polymer	1	The relationship among pressure-volume-temperature of thermoplastic polymer is described. The way of identifying the Tg, Tc is taught. Several equations of state are introduced.
Thermal Properties of Thermoplastic Polymers	2	Several important thermal properties of thermoplastic polymers, such as glass transition temp, Tg, crystallization temp, Tc, and melting temp, Tm are explained together with the measurement methods of those thermal properties. The latest measurement device, Flash DSC, is introduced with some of the interesting data of crystallization process.
Rheological Properties of Thermoplastic Polymers	2	The basic of polymer rheology, viscosity and elasticity, is given. Several phenomena of non-Newtonian fluid are introduced. The fundamental constitutive equations, Maxwell and Voigt models, describing the viscoelasticity of the polymers are explained. Exercising on identification of polymer structures, such as the degree of entanglement, molecular weight, presence of long-chain branch from the rheological data, relationship between polymer rheology and polymer structure is explained.
Basic Flows in Polymer Processing	1	The basics of Polymer Processing are the series of Melt, Flow and Shape. Here the class focus on the Flow. The two types flow, i.e., drag and pressure flows are explained together with master equation. Without solving the mathematical equations, the skill of estimating the velocity profile is cultivated.
Visual Observation of Flow Phenomena in Processing Machine	1	Entertaining several visual observation movies showing the flow phenomena in real polymer processing machine like injection molding machine and extruder, The effects of thermal and rheological properties of polymer on those flow phenomena are clarified.
Phase separation and Morphology Formation	2	The basic of phase separation of polymer-polymer, polymer-solvent are taught.
Phase Separation Phenomena in Polymer Processing	1	Several polymer processing schemes exploiting a phase separation phenomenon are introduced. Synergistic design of the polymer properties, processing scheme and processing machine is stressed.
Check what we learn	1	During the class, plenty of quiz are given to check the understanding.

【Textbook】Handout

【Textbook(supplemental)】Agassant, J.F., Polymer Processing: Principles and Modeling

【Prerequisite(s)】Basic of Transport Phenomena

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H017

Fine Particle Technology, Adv.
微粒子工学特論

【Code】10H017 【Course Year】Master and Doctor Course 【Term】Autumn 【Class day & Period】Mon 2nd

【Location】A2-303 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Dept. of Chem. Eng., Professor, 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】

10H020

Surface Control Engineering

界面制御工学

【Code】10H020 【Course Year】Master and Doctor Course 【Term】 【Class day & 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】

10C209

Non-ferrous extractive metallurgy, Adv.
非鉄製錬学特論

【Code】10C209 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	1	
	1	
	2	
	1	
	1	
	2	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H007

Chemistry of Polymer Materials

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day & 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
physical properties of polymers	3	physical properties of polymers
structure and physics of high-performance polymers	3	structure and physics of high-performance polymers
molecular design and function of functional polymers	6	molecular design and function of functional polymers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H031

Chemistry of Biomaterials
生体材料化学

【Code】10H031 【Course Year】Master Course 【Term】 【Class day & 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
biological functions in light of biomaterials	6	
cross-talk of polysaccharide with living systems	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【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】1st 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】

10H815

Biorecognics
生体認識化学

【Code】10H815 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H813

Bioorganic Chemistry
生物有機化学

【Code】10H813 【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】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H816

Microbiology and Biotechnology
生物工学

【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】

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】

Physical Organic Chemistry
物理有機化学

【Code】10H808 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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, Flanck-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
Phororeaction, Photoisomerization	2	Quantum yield, Photochromism, Conversion in photoisomerization

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H818

Advanced Organic Chemistry
先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】1st term 【Class day & 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】

Theme	Class number of times	Description
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Rections
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	2	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H836

Advanced Biological Chemistry
先端生物化学

【Code】10H836 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10P836

Advanced Biological Chemistry 2 Continued
先端生物化学続論

【Code】10P836 【Course Year】Master Course 【Term】 【Class day & 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】

10H448

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 & 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】

10H409

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 reseach fields, chemistry and biologi are being closely related each other. In this class,progress in such interdisciplinary areas and topics including natural products, biophysics, bioimaging , baimaterials, regenerative medicine, microbiology, thermal biology, strucural biology, chemical biology, molecular physiology and others, are briefly explained and discussed.

【Grading】Evaluation will be conducted by attendance and scores for excercises 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 indicvidual researchers and engineers.

【Course Topics】

Theme	Class number of times	Description
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.

10H641

Physiology
生理学

【Code】10H641 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
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	1	
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	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W641

Physiology

生理学

【Code】10W641 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	3	
	2	
	2	
	2	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10R001

Quantum Beam Science, Adv.

量子ビーム科学特論

【Code】10R001 【Course Year】Doctor Course 【Term】1st term 【Class day & 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】

10C018

Neutron Science
中性子科学

【Code】10C018 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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 & 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
	14	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C082

Applied Neutron Engineering
応用中性子工学

【Code】10C082 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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 & 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】

10V003

Biomechanics

バイオメカニクス

【Code】10V003 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【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 & 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 & 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】

Green and Sustainable Chemistry
物質環境化学

【Code】10H202 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Mon 2nd

【Location】A2-303 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】K.Ohe,Y.Tsuji,T.Sakka,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	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】

10H207

Excited-State Hydrocarbon Chemistry

励起物質化学

【Code】10H207 【Course Year】Master and Doctor Course 【Term】【Class day & 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	
	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】

10H002

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】Department of Chemical Engineering, Professor, 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	3	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】This is an biennial course which will be open in 2016, 2018, 2020, ...

10H003

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】Department of Chemical Engineering, Professor, 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	3	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】

10H008

Chemical Reaction Engineering, Adv.

反応工学特論

【Code】10H008 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

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

【Instructor】Prof. Motoaki Kawase, Department of Chemical Engineering; Assoc. Prof. Hiroyuki Nakagawa, Department of Chemical Engineering

【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】

10H009

Chemical Reaction Engineering, Adv.（English lecture）

Chemical Reaction Engineering, Adv.

【Code】10H009 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 3rd 【Location】A2-302 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】English

【Instructor】Prof. Motoaki Kawase, Department of Chemical Engineering; Assoc. Prof. Hiroyuki Nakagawa, Department of Chemical Engineering; Junior Assoc. Prof. Ryuichi Ashida, Department of Chemical Engineering

【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】

Theme	Class number of times	Description
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】

10H005

Separation Process Engineeering, Adv.

分離操作特論

【Code】10H005 【Course Year】Master and Doctor Course 【Term】Spring term 【Class day & Period】Mon 2nd 【Location】A2-305 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】N.Sano,

【Course Description】The separation related with transport phenomena of heat and mass and particles will be lectured. Adsorption, drying, distillation will be explained. In addition, new separation methods will be explained.

【Grading】Reports submitted from students and exams will be evaluated.

【Course Goals】This course will deepen the students' understanding on multiphase transport phenomena by lecturing separation operations, and the students will know how to develop effective separation methods. Also they will know recent developments of separation techniques in chemical engineering.

【Course Topics】

Theme	Class number of times	Description
Separation using electric field	2	Purification of gas and water using electric discharges and particle separation using dielectrophoresis are explained.
Distillation	2	Distillation is used commonly in chemical industries. Here, advanced knowledge on distillation about multi-component distillation, extraction distillation, etc. will be explained.
Drying	1	Drying is a typical operation utilizing phase transformation and simultaneous transport of heat and mass. Wet bulb temperature, adiabatic cooling change, humidity chart, etc. will be explained to deepen students' understanding on drying.
Drying mechanism and preservation of product quality	1	Conditions to keep the product quality from the view point of optimizing drying operation will be explained. Troubles like non-uniform component concentration, deformation, cracking, flavor loss, and so forth will be explained, and students will know how to deal with these troubles.
Design of drying units and trouble shooting in drying processes	1	A variety of drying units are used, and the points to designing these units will be lectured. Many examples of troubles seen in drying operations will be explained.
Basics of adsorption	2	Analysis using adsorption is used for structural analysis of porous materials, and it is important to evaluate adsorbents. Here, basic knowledge about these analysis will be explained.
Properties of adsorbent and recent adsorption techniques	1	Features and properties of typical adsorbents should be known to select appropriate species of adsorbents. These points will be lectured. Some methods to synthesize adsorbents from waste materials are explained. In addition, idea about how to reduce the cost for adsorption operation will be lectured.
Basics of extraction	1	Liquid-liquid extraction will be lectured from fundamentals to advanced type of operations, related with extraction of valuable metals.

【Textbook】"Gendai Kagaku Kogaku" Hashimoto and Ogino, Sangyo Tosho; "Kanso Gijustu Jitsumu Nyumon" Tamon, Nikkan Kogyo Shinbun

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge about transport phenomena and separation engineering should be required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10K001

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 5th 【Location】A2-306 【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction

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

【Instructor】GL Edu. Center, J. Assoc. Prof., Ryuichi Ashida
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】Requirements and a number of credits are different with the academic system students choose, the modified academic quarter system or the academic semester system. Students who choose the academic semester system must meet the requirements for the first 11 lectures and the latter 4 lectures separately.
When the students who choose the modified quarter system are graded, the average score of the best four reports is employed. When the students who choose the academic semester system are graded, the average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Materials Processing Using External Fields for Microstructure Control	1	Properties of materials are not simply determined by crystal structure and chemical composition. Microstructure (i.e. crystal grain size, crystallographic orientation) can significantly influence the properties. Materials processing for the microstructure control, using external fields will be demonstrated in this class. (H. Yasuda: Dept. of Materials Science and Engineering)
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. (Y. Nakao: Dept. of Material Chemistry)
Synthesis and Functions of Mixed Anion Compounds	1	As we entered the 21st century, mixed anion compounds, which contain several different anions, began to draw attention as new types of inorganic material. My lecture will show synthetic and functional aspects in this class of materials. (H. Kageyama: Dept. of Energy and Hydrocarbon Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
Photonic Crystal Technology	1	Photonic crystals are materials with periodic modulation of refractive index, in which a frequency range that existence of photon is prohibited (i.e. photonic band gap) can be formed. In this class, basics and applications of photnic crystals are introduced. (T. Asano: Dept. of Electronic Science and Engineering)
Introduction to Nuclear Materials	1	Nuclear materials are designed for irradiation field of neutron and high-energy particles. Some topics of nuclear transmutation, thermonuclear fusion, boron neutron capture therapy and others will be talked. (I. Takagi: Dept. of Nuclear Engineering)
Application of Polymer Nanoparticles to Bio-Imaging	1	Polymers are widely used in various delivery/localization events as drug carriers, stabilizers of clinical protein and nucleic acid medications, and lesion targeters. An obvious merit of polymers with an appropriate (>10 nm) size is that they escape from facile renal excretion. The size has another significance in case of tumor targeting. Tumor tissues usually have defective endothelial cells with a wide opening and undeveloped lymphatic vessel, so that polymer nanoparticles of the size range of 10 － 100 nm can permeate into the tumor and are retained therein. This is the so-called enhanced permeability and retention (EPR) effect, which shows high performance in terms of selectivity and efficiency in bio-imaging. (T. Kondo: Dept. of Energy and Hydrocarbon Chemistry)
Radiation Induced Reactions towards 1 -Dimensional Nanomaterials	1	Whether can we produce nano-material by the reactions induced by a “ ray ” (ionizing radiation)? The answer is yes. With an use of an atomic particle accelerated up to MeV orders, the one particle provides a nanowire along its trajectory via condensed and efficient chemical reactions in organic media. Single particle Nanofabrication Technique (SPNT) or Single Particle Triggered Linear Polymerization (STLiP), referred as, are demonstrated as versatile methods to give low dimensional nanomaterials based on a variety of organic molecular systems in this lecture. (S. Seki: Dept. of Molecular Engineering)
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. (K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
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. (H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Designing Polymer Membrane Materials to Capture Green House Gases	1	We will discuss the overall obstacles involved in capturing green house gases such as CO2 or Methane, and the specific challenges to generating polymer membranes that can achieve it. Then we will consider how to design polymer materials that can overcome such obstacles. (E. Sivaniahi: Dept. of Molecular Engineering)
Oxide Magnetic Materials	1	The aim of the lecture is to review the fundamentals and applications of oxide magnetic materials. Main topics include fundamentals of magnetism, magnetic properties of oxides, magneto-optics of oxides, oxides for spintronics, and multiferroic oxides. (K. Tanaka: Dept. of Material Chemistry)
Force Acting on Colloidal Particles	1	Colloid means small particles dispersed in a liquid solvent. Theoretical approaches on several forces acting on colloidal particles such as thermal, hydrodynamic, and electrostatic forces will be discussed. (R. Yamamoto: Dept. of Chemical Engineering)
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. (K. Murase: Dept. of Materials Science and Engineering)

【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.

10K005

Advanced Modern Science and Technology（English lecture）

現代科学技術特論 (英語科目)

【Code】10K005 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system) 【Restriction】No Restriction
【Lecture Form(s)】Relay Lecture 【Language】English
【Instructor】 GL Edu. Center, J. Assoc. Prof., Ryosuke Matsumoto
Related professors
【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】Students who choose the academic semester system must meet the requirements for the first 11 lecturers and the latter 4 lecturers separately.
When evaluating your grade, I employ the average score of best four reports for students who chose the modified quarter system, and best five reports for students who chose academic semester system.
Please go to KULASIS Web site. You can find an attachment file, ”通知版：2016 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
Exploration of Radiation Belts by Space Radio Engineering	1	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.(Y. Omura: Dept. of Electrical Engineering)
Functional Organic Molecular Materials for Molecular Scale Nanoscience	1	This lecture explains functional organic molecular materials with functions like photochromism or molecular conductance, which are expected to play an active role in molecular scale nanoscience.(K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
Micro- and Nano-scale Separations in Analytical Chemistry	1	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.(K. Otsuka: Dept. of Material Chemistry)
Role of Nanoparticles Aiming at Theranostic Agents for Solid Cancers － Sustainable Universe Health Care in the Aged Society	1	Malignancy takes the first position for the cause of mortality in Japan. Realization of a “society of health and longevity” therefore requires a general method for diagnosis and therapy for cancers in the early stage. Nanoparticles are currently highly expected to this type of medicinal treatment, because nanoparticles can avoid expensive therapy, which would bankrupt our universal health care system.(S. Kimura: Dept. of Material Chemistry)
What are polymers?	1	What is a polymer? Also, what is the difference between polymers and other molecules? The characteristics of polymers and polymerizations are explained with some examples on practical applications of polymers.(M. Ouchi: Dept. of Polymer Chemistry)
Precision Polymerization and Functional Materials by Macromolecular Design	1	The methodology to synthesize polymers precisely and their features are described. In addition, some examples on functional materials using polymers whose molecular design is important are introduced.(M. Ouchi: Dept. of Polymer Chemistry)
Analysis and Design of Socio-Technical Systems	1	When introducing various kinds of automation systems including robots into a new work environment, it is necessary to design and analyze from the viewpoint of socio-technical systems, which is the interaction system of people, technology and organization. In this lecture, specific problems and solutions are described.(T. Sawaragi: Dept. of Mechanical Engineering and Science)
Computational Chemistry and computer science	1	Remarkable progress in the computer science has been revolutionizing scientific research and technological development for this decade. This trend will further accelerate in the future. This lecture reviews the impact of state of the art computer science on the molecular chemistry as an example.(R. Fukuda: Dept. of Molecular Engineering)
Photofunctional Single-Walled Carbon Nanotubes	1	Basic chemical properties of single-walled carbon nanotubes are introduced, and then applications of them as photofunctional molecular platform and charge transport pathway are presented. (T. Umeyama: Dept. of Molecular Engineering)
Renewable energies and rechargeable batteries	1	For the effective use of renewable energies,rechargeable batteries have been focused. Basic chemistry of batteries and how the rechargeable batteries are utilized for the storage of the energies will be given by the first lecture.(T. Abe: Energy and Hydrocarbon Chemistry)
Renewable energies and hydrogen production	1	Fuel cells using hydrogen are clean energy sources. The second lecture is about the hydrogen production based on the renewable energies.(T. Abe: Energy and Hydrocarbon Chemistry)
Genome sequences, what do they say and how can we use them?	1	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.(H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Optical clocks -measurement of time at the 18th decimal place	1	Time or frequency is the most precisely measurable quantity. Clocks referenced to atomic resonances, called atomic clocks, have extremely small uncertainties. They realize the definition of second and are applied to the global positioning system (GPS). This lecture introduces atomic clocks based on lasers, which improve the uncertainty to be the 18th decimal place.(K. Sugiyama: Dept. of Electronic Science and Engineering)
Mechanism of particle electrification	1	The basic concepts and theories of charge transfer between solid surfaces are summarized and particle electrification caused by repeated impacts on a wall is formulated.(S. Matsusaka: Dept. of Chemical Engineering)
Control of electrostatic charge on particles	1	On the basis of the concepts and formulation on particle electrification, new methods for the control of electrostatic charge on particles are presented.(S. Matsusaka: Dept. of Chemical Engineering)

【Textbook】None
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】Students who take Autumn term should register Lecture code 10H006.

10D051

Frontiers in Modern Science & Technology

現代科学技術の巨人セミナー「知のひらめき」

【Code】10D051 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Wed 5th 【Location】Funai Hall
【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
【Instructor】GL center: J.Assoc. Tanaka, Mizuno, Takatori, Matsumoto, Ashida and Related professors
【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.
【Grading】Refer material about grading this course which is provided in 1st and 2nd lectures.
【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.
【Course Topics】

Theme	Class number of times	Description
Construction of solar updraft power generation (SUPG) system on the ocean	1	Prof. Kunimasa Sugiura (Civil and Earth Resources Engineering) Apr. 12
Record and protection of world cultural heritage by advanced image processing	1	Prof. Ari Ide (Mechanical Engineering and Science) Apr. 19
Mysterious characteristics of smell: from development of smell identification device	1	Dr. Jun-ichi Kita (Shimadzu Corporation） Apr. 26
Science and engineering of metals and potential of metals	1	Prof. Nobuhiro Tsuji (Materials Science and Engineering) May 10
My days with radiation ray	1	Dr. Katsumi Hayashi (Hitachi, Corporation) May 17
Material synthesis considering feeling of molecules	1	Prof. Yasujiro Murata (Energy and Hydrocarbon Chemistry) May 24
Practical Marketing not on books	1	Dr. Fuminori Takaoka (Edge, Ltd.) May 31
Direct visualization of atoms and molecules	1	Prof. Hirofumi Yamada (Electronic Science and Engineering) Jun. 7
Encouragement for serial innovator	1	Prof. Mitsuaki Oshima (Panasonic Corporation) Jun. 14
Idle time and idle space	1	Prof. Kiyoshi Takeyama (Architecture and Architectural Engineering) Jun. 21
Research of cancer therapy by heavy ion beams	1	Dr. Koji Noda (National Institutes for Quantum and Radiological Science and Technology) Jun. 28
Seven Wonders of powders	1	Prof. Shuji Matsusaka (Chemical Engineering) Jul. 5
Strong company organizations in Japan, USA and Germany	1	Dr. Masahiko Mori (DMG MORI Co.,Ltd.) Jul. 12
Development of construction techniques: from development of advanced technique to big projects	1	Dr. Ichiro Nagashima (Taisei Corporation) Jul. 19
Manufacturing by advanced optical machining	1	Prof. Kiyotaka Miura (Material Chemistry) Jul. 26

【Textbook】Course materials will be provided.
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10i045

Exercise in Practical Scientific English Ⅰ

実践的科学英語演習Ⅰ

【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 20 students for each class 【Lecture Form(s)】Seminar 【Language】English (Japanese)

【Instructor】M. Nishikawa, Y. Tanaka, T. Mizuno, A. Takatori, R. Matsumoto, R. Ashida

【Course Description】This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding. approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】Evaluation based on 10% participation, 60% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】Handout materials will be supplied by the instructor.

【Textbook(supplemental)】ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 .（2007）.『理系英語のライティング』. アルク

【Prerequisite(s)】Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【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. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

10D043

Instrumental Analysis, Adv. Ⅰ

先端科学機器分析及び実習Ⅰ

【Code】10D043 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv. Ⅱ
先端科学機器分析及び実習 II

【Code】10D046 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W681

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 & 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

【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 & 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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10W670

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 & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【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 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 & Period】 【Location】

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

10W685

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 & Period】 【Location】

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

10W687

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 & Period】 【Location】

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

10W689

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 & Period】 【Location】

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

10W690

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 & Period】 【Location】

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

10W691

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 & Period】 【Location】

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

10W692

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 & Period】 【Location】

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

10i041

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 & Period】Thu 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)】Semina ｒ 【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.

10i042

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】2nd term 【Class day & 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&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	Course contents, goals
Cost concepts and design economics	1	Cost terminology and classification
Cost estimation techniques	1	WBS for cost estimation, estimation techniques (indexes, unit, factor, power-sizing, learning curve, CER, top down, bottom up), target costing
The time value of money	1	Simple interest, compound interest, economic equivalence concept, cash-flow diagrams, PW, FW, AW
Evaluating a single project	1	MARR, present wort method, bond value, capitalized worth, internal rate of return, external rate of return, payback method
Comparison and selection among alternatives	1	Investment and cost alternatives, study period, equal and unequal useful lives, rate-of-return method, imputed market value
Depreciation and income taxes	1	SL and DB depreciation methods, book value, after-tax MARR, marginal income tax rate, gain(loss) on asset disposal, after-tax economic analysis general procedure, EVA,
Price changes and exchange rates	1	Actual dollars, real dollars, inflation, fixed and responsive annuities, exchange rates, purchasing power
Replacement analysis	1	Determining economic life of challenger, determining economic life of defender, abandonment, after-tax replacement study
Evaluating projects with the benefit-cost ratio method	1	Benefits, costs, dis-benefits, self-liquidating projects, multi-purpose projects, interest rate vs. public project, conventional B-C ratio PW and AW method, modified B-C ratio PW and AW method
Breakeven and sensitivity analysis	1	Breakeven analysis, sensitivity analysis, spider plot
Probabilistic risk analysis	1	Sources of uncertainty, discrete and continuous variables, probability trees, Monte Carlo simulation example, decision trees, real options analysis
The capital budgeting process	1	Capital financing and allocation, equity capital and CAPM, WACC, WACC relation to MARR, opportunity cost
Decision making considering multiattributes	1	Non-compensatory models (dominance, satisficing, disjunctive resolution, lexicography), compensatory models (non-dimensional scaling, additive weight)
Final test	1	90 minutes, concept questions, calculation task (option of choice)
		Additionally, students will submit three 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 “ Project Management in Engineering" 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 Oct.3rd.

10i049

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】10i049 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 4th 【Location】A2-308 【Credits】2

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

【Instructor】GL center: J.Assoc.Prof. Takatori, Mizuno, Tanaka, Matumoto, Ashida

Assoc.Prof. Lintuluoto

【Course Description】This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】Evaluated by assignments (project report exercise) and class contribution

【Course Goals】This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course "Seminar on Project Management in Engineering." in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/14 (Ashida) Course guidance
Introduction to project management & Project phases	1	4/21 (Takatori) Introduction to project management Project phases
Tools for project management, cost, and cash flows I	1	4/28 (Lintuluoto) Tools Work breakdown structure Gantt charts
Project scheduling I	1	5/12 (Ashida) Project scheduling I
Project scheduling II	1	5/19 (Ashida) Project scheduling II
Tools for project management, cost, and cash flows II	1	5/26 (Lintuluoto) Cost
Tools for project management, cost, and cash flows III	1	6/2 (Lintuluoto) Cash flow
TBA	1	6/9 To be announced
Leadership I	1	6/16 (Tanaka) Leadership I
Leadership II	1	6/23 (Tanaka) Leadership II
Risk I	1	6/30 (Matsumoto) Risk I
Risk II	1	7/7 (Matsumoto) Risk II
Environmental Impact Assessment I	1	7/14 (Mizuno) Environmental Impact Assessment I
Environmental Impact Assessment II	1	7/21 (Mizuno) Environmental Impact Assessment II
Special lecture Project management ~Tender process of Panama Canal expansion project~	1	7/28 @ A2-306 (Cluster A, Katsura Campus) Lecturer: Taizo SHIMOMURA, Dr. (TAISEI CORPORATION)

【Textbook】Course materials will be provided.

【Textbook(supplemental)】1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】No pre-requisite

【Independent Study Outside of Class】

【Web Sites】The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】10i050 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 5th

【Location】B-Cluster 2F Seminar Room 【Credits】1 【Restriction】Student number will be limited.

【Lecture Form(s)】Seminar 【Language】English

【Instructor】GL center: J.Assoc.Prof. Mizuno, Tanaka, Matumoto, Ashida, Maeda
Assoc.Prof. Lintuluoto

【Course Description】In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering 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, presentations, and a few intermediate discussions. 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	10/6 Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】Course materials will be provided.

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】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】The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

10X001

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 & 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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X003

Advanced Experiments and Exercises in Interdisciplinary Photonics and Electronics Ⅰ

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	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Experiments and Exercises in Interdisciplinary Photonics and Electronics Ⅱ

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	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X007

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 & Period】 【Location】

【Credits】4 【Restriction】 【Lecture Form(s)】 【Language】 【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】

10C825

Quantum Mechanics for Electronics Engineering

量子論電子工学

【Code】10C825 【Course Year】Master Course 【Term】1st term 【Class day & 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	
	2	
	2	
	1	
	1	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C800

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 & Period】Tue 2nd 【Location】A1-131 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English or Japanese (depends on students) 【Instructor】Masashi Shiraishi

【Course Description】Spintronics is now attracting tremendous attention, and is recognized as one of the most potential candidates to overcome the limit of the Moore's law. Spintronics possesses attractive and profound basis physics and also a potential to practical applications towards MRAMs and spin FETs. In this lecture, I introduce some important and basic theories and experimental techniques in spintronics using semiconductors, metals, insulators, oxides and so on.

【Grading】Report submission

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Spin is a quantum quantity, and thus it is to induced by rotation of an electron (an electron is an elementary particle, i.e., it has no domain. Thus, rotation of an electron cannot be defined). Nevertheless, the spin degree of freedom can be coupled to spatial rotation because spin is a generator of infinitesimal rotation. I explain the essence of spin, its SU(2) algebra and so on.
Relativistic quantum physics and spin-orbit interaction	5	To understand spin manipulation and spin coherence in semiconductor, it is quite important what the spin-orbit interaction (SOI) is. The SOI is a manifestation of a relativistic effect, and the Dirac equation, the equation of motion in relativistic quantum physics, is derived to understand the SOI. Next, the SOI is explicitly derived be expanding the Dirac equation. As a related important topic, electron motion in graphene, which can be described as massless Dirac fermion, and the Berry phase (a geometric phase that plays an important role in spintronics) of electrons in graphene are discussed.
Electrical and dynamical spin injection into condensed matters and generation of pure spin current	5-6	Pure spin current is a quite significant physical current in spintronics using semiconductors and so on. Pure spin current is a current of only a spin degree of freedom without a net charge flow. I introduced some important papers and show how to derive essential equations describing generation and propagation of pure spin current. (1) Spin drift-diffusion equation, (2) Hanle-type spin precession, (3) spin pumping using magnetization dynamics, and (4) spin current circuit theory are discussed.
Recent topics in spintronics	2-3	Topological insulators and the Berry phase are important topics in modern spintronics. To understand the essence of them, I show the derivation of the Kubo formula, and the calculation of the Hall conductivity based on the Kubo theory. The above mentioned topics are the main contents of this lecture, but I may add or omit some topics as requests from students.

【Textbook】None

【Textbook(supplemental)】For foreign students, I recommend the following review articles: 1. Spin Hall effect, J. Sinova et al., Rev. Mod. Phys. 87, 1213 (2015). 2. Spintronics: Fundamentals and applications, I. Zutic et al., Rev. Mod. Phys. 76, 1 (2004). 3. Nonlocal magnetization dynamics in ferromagnetic heterostructures, Y. Tserkovnyak et al., Rev. Mod. Phys. 77, 1375 (2005).

【Prerequisite(s)】Solid State Physics and Quantum Physics at the level of undergraduate school.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C801

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, achievment test will be performed.

【Textbook】Yasuhito Gotoh, Charged Particle Beam Appratus, 2016 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.

10C803

Quantum Information Science

量子情報科学

【Code】10C803 【Course Year】Master Course 【Term】1st term 【Class day & Period】Mon 3rd

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

【Language】English or Japanese

【Instructor】Professor Shigeki Takeuchi
Associate Professor Ryo Okamoto

【Course Description】An overview of the quantum information sciences will be given. The topics includes the basic picture of wave/particle duality, quantum key distribution, quantum computation, quantum communication, quantum measurements.

【Grading】the number of days one has attended, and the score of reports will be considered.

【Course Goals】To understand the basic concepts/mechanisms of quantum key distribution, quantum computers, and quantum metrology so that one can read and understand the scientific papers of the related area.

【Course Topics】

Theme	Class number of times	Description
Introduction	3	First, we outline the whole lecture and then explain basic concepts such as quantum bit, quantum gate, quantum entanglement etc.
Quantum Computer (Theory)	3	On quantum computation, various quantum algorithms are discussed.
Quantum Computer (Experiment)	3	Quantum information processing is being studied in various physical systems such as photon, ion trap, nuclear spin and the like. We will explain how to realize them.
Quantum Key distribution and Quantum metrology	4	Describe the basic concept of quantum cryptography and quantum measurements and their recent research trends.
Summary and Outlook	2	In addition to summarizing the whole, if time permits, discuss the problems of quantum information science and ethics.

【Textbook】No text book will be used.

【Textbook(supplemental)】Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press
Shigeki Takeuchi, Quantum Computer, Kodansha (in Japanese)

【Prerequisite(s)】Basic understanding of quantum mechanics will be helpful.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】We welcome your positive questions and comments. We select the language (Japanese or English) used in the lectureb taking into account the situation and hope of the students taking this lecture.

10C810

Semiconductor Engineering Adv.
半導体工学特論

【Code】10C810 【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】,

【Course Description】This course explores the fundamentals of physics of semiconductors, which are esseantial 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 approachs, 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 & 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】

10C816

Molecular Electronics

分子エレクトロニクス

【Code】10C816 【Course Year】Master Course 【Term】1st term 【Class day & 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 & Period】Tue 5th 【Location】

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

10C822

Optical Properties and Engineering

光物性工学

【Code】10C822 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10C828

Quantum Optoelectronics Devices

光量子デバイス工学

【Code】10C828 【Course Year】Master Course 【Term】2nd term 【Class day & 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 & 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】

10C830

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, but there is a possibility of some lectures in English. 【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 theoritical 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】Office of instructor: A1-124

10C851

Electrical Conduction in Condensed Matter
電気伝導

【Code】10C851 【Course Year】Master 1st 【Term】1st term 【Class day & 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】

10C834

High Performance Thin Film Engineering
高機能薄膜工学

【Code】10C834 【Course Year】Master 1st 【Term】1st term 【Class day & 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	
	3-4	
	3-4	
	2-3	
	2-3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693631

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 & 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. All reports are mandatory.

【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 resister 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】Reports include design and analysis of small circuits. A simulation program (SPICE) is required for performance analysis. Instructions for obtaining SPICE are given and students need to install SPICE by themselves.

【Web Sites】

【Additional Information】

10C628

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 or English

【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.

10C604

Applied Systems Theory

応用システム理論

【Code】10C604 【Course Year】Master 1st 【Term】2nd term 【Class day & 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】In principle, the grading will be based on the absolute and comprehensive 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. Checking degrees of understanding of all the lecture topics closes the class.

【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】

【Instructor】S. Doi & T. Hikihara

【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
Introduction 1	1	Several examples of linear operators encountered in electrical engineering, e.g. in quantum mechanics are explained. Then, Linear vector space is reviewed and linear dynamical system is introduced.
Fundamentals of linear vector space	2-4	Direct sum decomposition, projection operator, and the structure of vector spaces such as Jordan normal form are explained.
Linear dynamical system	3-5	On the basis of the knowledge of the vector space, linear dynamical systems theory is explained as a simple application of vector spaces.
Introduction 2	1	The introduction to nonlinear dynamics will be explained based on oscillation theory.
Hamiltonian mechanics	1-3	Hamiltonian mechanics is lectured on linear symplectic space.
Manifold and vector field	2-4	Manifold is discussed in nonlinear system with relation to vector filed 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. Thursday 1st class hour is due from April 13th.

10C647

Electrical and Electromagnetic Circuits

電気電磁回路論

【Code】10C647 【Course Year】Master 1st 【Term】1st term 【Class day & Period】Wed 2nd

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

【Language】Japanese 【Instructor】Osami Wada, Professor, Department of Electrical Engineering

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	
Circuit description including electromagnetic coupling effects	2	
Evaluation and description methods for high-frequency circuits	2	
Transmission line and its characteristics (1)	2	
Transmission line and its characteristics (2)	2	
Description of electromagnetic couplings	2	
E-system integrity design technology for electric and electronic systems	3	
Final exam and feedback	1	

【Textbook】Materials for this course will be distributed at the lectures.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C610

Electromagnetic Theory, Adv.
電磁気学特論

【Code】10C610 【Course Year】Master 1st 【Term】2nd term 【Class day & Period】Wed 3rd 【Location】

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

【Instructor】T. Matsuo,

【Course Description】The first half: the special theory of relativity and the covariance of Maxwell's equations
The latter half: the differential form in the electromagnetic field theory and its application to computational electromagnetics

【Grading】Submission of reports (twice)

【Course Goals】1. Understanding of the basic concepts of special theory of relativity and the covariant formulation of Maxwell's equations
2. Understanding of the basics of differential form in electromagnetic field theory

【Course Topics】

Theme	Class number of times	Description
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
Differential form in electromagnetic field theory	3-4	- Basics of differential form in electromagnetic field theory
Application to computational electromagnetics	3-4	- Application of integral form of Maxwell’s equations to computational electromagnetics

【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】

10C613

Superconductivity Engineering
超伝導工学

【Code】10C613 【Course Year】Master Course 【Term】1st term 【Class day & Period】Mon 4th 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【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 & 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	Study about detail structure of the human brain to understand higher brain functions. In particular, learn about cortical structure and functional map.
Neurones and glial cells	1	Study about detail structures and functions of neuron and glial cells.
Neuroimaging techniques	3	Study about measurement principles and analytical methods of representative non-invasive neuro-imaging techniques.
Sensory functions	2	Study about organizations of sensory systems such as visual, auditory and somatosensory systems.
Motor functions	1	Study about organizations and functions of primary motor, premotor and supplementary motor areas.
Electromagnetic fields in biological body	2	Physical phenomena inside and outside biological body caused by external and internal electromagnetic fields and electric currents.
Electromagnetic field analysis in biological body	2	Basics of electromagnetic field analysis in biological body. Characteristics of conductivity and permittivity of biological tissues.
Electrical and magnetic stimulation	1	Transcranial magnetic stimulation and deep brain stimulation.
Evaluation of understanding	1	We are going to check students' achievement by answering questions from students.

【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】

10C621

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】 【Location】A1-001

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

【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. The classes will be held on Wednesday or Thursday. Schedule is 4/13,20,27 [Hikihara], 5/11,18,25 [Azuma], 6/1,6/8 [Hikihara], 6/16,6/23,30, 7/7,14 (Thursday)[Doi], 7/21 [extra].

Theory of Electric Circuits, Adv.
電気回路特論

【Code】10C625 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Mon 2nd

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

【Language】Japanese and English 【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】

10C631

Design of Control Systems

制御系設計理論

【Code】10C631 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 2nd 【Location】

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

【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】

10C616

Electric Power Transmission System
電力輸送システム

【Code】10C616 【Course Year】Master Course 【Term】2nd term 【Class day & 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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10C611

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】

10C612

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】

【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】

10C617

Applied Microwave Engineering
マイクロ波応用工学

【Code】10C617 【Course Year】Master Course 【Term】1st term 【Class day & 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 resonnance coupling, energy harvesting, and applied microwave technologies of microwave processing, wireless communications, and radar.

【Grading】Reports

【Course Goals】Students learn about applied microwave engeering, 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 Tramsmission	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 overviwed.
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.

10C714

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 or English 【Instructor】Yuichi Nakamura, Kazuaki Kondo

【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	Dicrete 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 reconstrunction from a set of 2D images.
Measurement of Motions	1-2	Motion detection and measurement, and oject tracking.
Pattern Recognition	0-2	The basic idea of pattern recognition and usuful 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】

10C716

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 & 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】

10C263

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 & 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	
	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 & 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
	1	
	1	
	4	
	2	
	3	
	1	
	1	
	1	
	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 & 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】Micro/nano fabrication processes and materials used to realize micro/nano systems are described. Topics will be photolithography, dry-etching, thin-film deposition, which includes bulk micro machining, surface micro machining and further advanced polymer processing.

【Grading】Evaluated by homework. All report must be submitted to obtain credits.

【Course Goals】To obtain fundamental knowledge about design and fabrication of micro/nano systems and to be familiar with recent fabrication technologies and micro/nano systems.

【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	
Feedback	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 & 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】

10H413

Molecular Materials
分子機能材料

【Code】10H413 【Course Year】Master and Doctor Course 【Term】(not held; biennially)

【Class day & 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】

10H422

Molecular Materials Science

分子材料科学

【Code】10H422 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 2nd

【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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H007

Chemistry of Polymer Materials
高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day & 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
physical properties of polymers	3	physical properties of polymers
structure and physics of high-performance polymers	3	structure and physics of high-performance polymers
molecular design and function of functional polymers	6	molecular design and function of functional polymers

【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】2nd term 【Class day & Period】Thu 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】H. Ohkita

【Course Description】In this class, optoelectronic 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 applications, which include optical fibers, organic light-emitting diode, and organic solar cells.

【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	3	
Photofunctional Polymers	3	
Optoelectronic Polymers	4	

【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 chemisty course for undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693637

Digital Signal Processing, Advanced
ディジタル信号処理論

【Code】693637 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5-6	
	3-5	
	3-5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】For the syllabus of this course, refer to KULASIS->Graduate School of Informatics->Digital Signal Processing, Advanced

693622

Digital Communication Engineering
ディジタル通信工学

【Code】693622 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

693628

Information Network

情報ネットワーク

【Code】693628 【Course Year】Doctor Course 【Term】1st term 【Class day & 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
	2	
	5	
	3	
	1	
	1	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】http://www.i.kyoto-u.ac.jp/curriculum/syllabus.html

10X009

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 & Period】Tue 5th

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	9	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar in Interdisciplinary Photonics and Electronics Ⅰ，Ⅱ

融合光・電子科学特別研修 1(ｲﾝﾀｰﾝ)

【Code】10X015 【Course Year】Master Course 【Term】1st term 【Class day & 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
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X017

Advanced Seminar in Interdisciplinary Photonics and Electronics Ⅰ，Ⅱ

融合光・電子科学特別研修 2(ｲﾝﾀｰﾝ)

【Code】10X017 【Course Year】Master Course 【Term】1st term 【Class day & 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
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X019

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 & Period】 【Location】

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

10X021

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 & Period】 【Location】

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

10X023

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 & Period】 【Location】

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

10X025

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 & Period】 【Location】

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

10D051

Frontiers in Modern Science & Technology

現代科学技術の巨人セミナー「知のひらめき」

【Code】10D051 【Course Year】Master and Doctor Course 【Term】First term/Spring term 【Class day & Period】Wed 5th 【Location】Funai Hall
【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
【Instructor】GL center: J.Assoc. Tanaka, Mizuno, Takatori, Matsumoto, Ashida and Related professors
【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.
【Grading】Refer material about grading this course which is provided in 1st and 2nd lectures.
【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.
【Course Topics】

Theme	Class number of times	Description
Construction of solar updraft power generation (SUPG) system on the ocean	1	Prof. Kunimasa Sugiura (Civil and Earth Resources Engineering) Apr. 12
Record and protection of world cultural heritage by advanced image processing	1	Prof. Ari Ide (Mechanical Engineering and Science) Apr. 19
Mysterious characteristics of smell: from development of smell identification device	1	Dr. Jun-ichi Kita (Shimadzu Corporation） Apr. 26
Science and engineering of metals and potential of metals	1	Prof. Nobuhiro Tsuji (Materials Science and Engineering) May 10
My days with radiation ray	1	Dr. Katsumi Hayashi (Hitachi, Corporation) May 17
Material synthesis considering feeling of molecules	1	Prof. Yasujiro Murata (Energy and Hydrocarbon Chemistry) May 24
Practical Marketing not on books	1	Dr. Fuminori Takaoka (Edge, Ltd.) May 31
Direct visualization of atoms and molecules	1	Prof. Hirofumi Yamada (Electronic Science and Engineering) Jun. 7
Encouragement for serial innovator	1	Prof. Mitsuaki Oshima (Panasonic Corporation) Jun. 14
Idle time and idle space	1	Prof. Kiyoshi Takeyama (Architecture and Architectural Engineering) Jun. 21
Research of cancer therapy by heavy ion beams	1	Dr. Koji Noda (National Institutes for Quantum and Radiological Science and Technology) Jun. 28
Seven Wonders of powders	1	Prof. Shuji Matsusaka (Chemical Engineering) Jul. 5
Strong company organizations in Japan, USA and Germany	1	Dr. Masahiko Mori (DMG MORI Co.,Ltd.) Jul. 12
Development of construction techniques: from development of advanced technique to big projects	1	Dr. Ichiro Nagashima (Taisei Corporation) Jul. 19
Manufacturing by advanced optical machining	1	Prof. Kiyotaka Miura (Material Chemistry) Jul. 26

【Textbook】Course materials will be provided.
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10i045

Exercise in Practical Scientific English Ⅰ

実践的科学英語演習Ⅰ

【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 20 students for each class 【Lecture Form(s)】Seminar 【Language】English (Japanese)

【Instructor】M. Nishikawa, Y. Tanaka, T. Mizuno, A. Takatori, R. Matsumoto, R. Ashida

【Course Description】This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding. approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】Evaluation based on 10% participation, 60% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】Handout materials will be supplied by the instructor.

【Textbook(supplemental)】ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 .（2007）. 『理系英語のライティング』. アルク

【Prerequisite(s)】Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【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. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

10K001

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 5th 【Location】A2-306 【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction

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

【Instructor】GL Edu. Center, J. Assoc. Prof., Ryuichi Ashida
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】Requirements and a number of credits are different with the academic system students choose, the modified academic quarter system or the academic semester system. Students who choose the academic semester system must meet the requirements for the first 11 lectures and the latter 4 lectures separately.
When the students who choose the modified quarter system are graded, the average score of the best four reports is employed. When the students who choose the academic semester system are graded, the average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Materials Processing Using External Fields for Microstructure Control	1	Properties of materials are not simply determined by crystal structure and chemical composition. Microstructure (i.e. crystal grain size, crystallographic orientation) can significantly influence the properties. Materials processing for the microstructure control, using external fields will be demonstrated in this class. (H. Yasuda: Dept. of Materials Science and Engineering)
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. (Y. Nakao: Dept. of Material Chemistry)
Synthesis and Functions of Mixed Anion Compounds	1	As we entered the 21st century, mixed anion compounds, which contain several different anions, began to draw attention as new types of inorganic material. My lecture will show synthetic and functional aspects in this class of materials. (H. Kageyama: Dept. of Energy and Hydrocarbon Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
Photonic Crystal Technology	1	Photonic crystals are materials with periodic modulation of refractive index, in which a frequency range that existence of photon is prohibited (i.e. photonic band gap) can be formed. In this class, basics and applications of photnic crystals are introduced. (T. Asano: Dept. of Electronic Science and Engineering)
Introduction to Nuclear Materials	1	Nuclear materials are designed for irradiation field of neutron and high-energy particles. Some topics of nuclear transmutation, thermonuclear fusion, boron neutron capture therapy and others will be talked. (I. Takagi: Dept. of Nuclear Engineering)
Application of Polymer Nanoparticles to Bio-Imaging	1	Polymers are widely used in various delivery/localization events as drug carriers, stabilizers of clinical protein and nucleic acid medications, and lesion targeters. An obvious merit of polymers with an appropriate (>10 nm) size is that they escape from facile renal excretion. The size has another significance in case of tumor targeting. Tumor tissues usually have defective endothelial cells with a wide opening and undeveloped lymphatic vessel, so that polymer nanoparticles of the size range of 10 － 100 nm can permeate into the tumor and are retained therein. This is the so-called enhanced permeability and retention (EPR) effect, which shows high performance in terms of selectivity and efficiency in bio-imaging. (T. Kondo: Dept. of Energy and Hydrocarbon Chemistry)
Radiation Induced Reactions towards 1 -Dimensional Nanomaterials	1	Whether can we produce nano-material by the reactions induced by a “ ray ” (ionizing radiation)? The answer is yes. With an use of an atomic particle accelerated up to MeV orders, the one particle provides a nanowire along its trajectory via condensed and efficient chemical reactions in organic media. Single particle Nanofabrication Technique (SPNT) or Single Particle Triggered Linear Polymerization (STLiP), referred as, are demonstrated as versatile methods to give low dimensional nanomaterials based on a variety of organic molecular systems in this lecture. (S. Seki: Dept. of Molecular Engineering)
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. (K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
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. (H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Designing Polymer Membrane Materials to Capture Green House Gases	1	We will discuss the overall obstacles involved in capturing green house gases such as CO2 or Methane, and the specific challenges to generating polymer membranes that can achieve it. Then we will consider how to design polymer materials that can overcome such obstacles. (E. Sivaniahi: Dept. of Molecular Engineering)
Oxide Magnetic Materials	1	The aim of the lecture is to review the fundamentals and applications of oxide magnetic materials. Main topics include fundamentals of magnetism, magnetic properties of oxides, magneto-optics of oxides, oxides for spintronics, and multiferroic oxides. (K. Tanaka: Dept. of Material Chemistry)
Force Acting on Colloidal Particles	1	Colloid means small particles dispersed in a liquid solvent. Theoretical approaches on several forces acting on colloidal particles such as thermal, hydrodynamic, and electrostatic forces will be discussed. (R. Yamamoto: Dept. of Chemical Engineering)
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. (K. Murase: Dept. of Materials Science and Engineering)

【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.

10K005

Advanced Modern Science and Technology（English lecture）

現代科学技術特論 (英語科目)

【Code】10K005 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system) 【Restriction】No Restriction
【Lecture Form(s)】Relay Lecture 【Language】English
【Instructor】 GL Edu. Center, J. Assoc. Prof., Ryosuke Matsumoto
Related professors

【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】Students who choose the academic semester system must meet the requirements for the first 11 lecturers and the latter 4 lecturers separately.
When evaluating your grade, I employ the average score of best four reports for students who chose the modified quarter system, and best five reports for students who chose academic semester system.
Please go to KULASIS Web site. You can find an attachment file, ”通知版：2016 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
Exploration of Radiation Belts by Space Radio Engineering	1	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.(Y. Omura: Dept. of Electrical Engineering)
Functional Organic Molecular Materials for Molecular Scale Nanoscience	1	This lecture explains functional organic molecular materials with functions like photochromism or molecular conductance, which are expected to play an active role in molecular scale nanoscience.(K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
Micro- and Nano-scale Separations in Analytical Chemistry	1	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.(K. Otsuka: Dept. of Material Chemistry)
Role of Nanoparticles Aiming at Theranostic Agents for Solid Cancers － Sustainable Universe Health Care in the Aged Society	1	Malignancy takes the first position for the cause of mortality in Japan. Realization of a “society of health and longevity” therefore requires a general method for diagnosis and therapy for cancers in the early stage. Nanoparticles are currently highly expected to this type of medicinal treatment, because nanoparticles can avoid expensive therapy, which would bankrupt our universal health care system.(S. Kimura: Dept. of Material Chemistry)
What are polymers?	1	What is a polymer? Also, what is the difference between polymers and other molecules? The characteristics of polymers and polymerizations are explained with some examples on practical applications of polymers.(M. Ouchi: Dept. of Polymer Chemistry)
Precision Polymerization and Functional Materials by Macromolecular Design	1	The methodology to synthesize polymers precisely and their features are described. In addition, some examples on functional materials using polymers whose molecular design is important are introduced.(M. Ouchi: Dept. of Polymer Chemistry)
Analysis and Design of Socio-Technical Systems	1	When introducing various kinds of automation systems including robots into a new work environment, it is necessary to design and analyze from the viewpoint of socio-technical systems, which is the interaction system of people, technology and organization. In this lecture, specific problems and solutions are described.(T. Sawaragi: Dept. of Mechanical Engineering and Science)
Computational Chemistry and computer science	1	Remarkable progress in the computer science has been revolutionizing scientific research and technological development for this decade. This trend will further accelerate in the future. This lecture reviews the impact of state of the art computer science on the molecular chemistry as an example.(R. Fukuda: Dept. of Molecular Engineering)
Photofunctional Single-Walled Carbon Nanotubes	1	Basic chemical properties of single-walled carbon nanotubes are introduced, and then applications of them as photofunctional molecular platform and charge transport pathway are presented. (T. Umeyama: Dept. of Molecular Engineering)
Renewable energies and rechargeable batteries	1	For the effective use of renewable energies,rechargeable batteries have been focused. Basic chemistry of batteries and how the rechargeable batteries are utilized for the storage of the energies will be given by the first lecture.(T. Abe: Energy and Hydrocarbon Chemistry)
Renewable energies and hydrogen production	1	Fuel cells using hydrogen are clean energy sources. The second lecture is about the hydrogen production based on the renewable energies.(T. Abe: Energy and Hydrocarbon Chemistry)
Genome sequences, what do they say and how can we use them?	1	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.(H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Optical clocks -measurement of time at the 18th decimal place	1	Time or frequency is the most precisely measurable quantity. Clocks referenced to atomic resonances, called atomic clocks, have extremely small uncertainies. They realize the definition of second and are applied to the global positioning system (GPS). This lecture introduces atomic clocks based on lasers, which improve the uncertainty to be the 18th decimal place.(K. Sugiyama: Dept. of Electronic Science and Engineering)
Mechanism of particle electrification	1	The basic concepts and theories of charge transfer between solid surfaces are summarized and particle electrification caused by repeated impacts on a wall is formulated.(S. Matsusaka: Dept. of Chemical Engineering)
Control of electrostatic charge on particles	1	On the basis of the concepts and formulation on particle electrification, new methods for the control of electrostatic charge on particles are presented.(S. Matsusaka: Dept. of Chemical Engineering)

【Textbook】None
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】Students who take Autumn term should register Lecture code 10H006.

10X301

Human Security Engineering

人間安全保障工学概論

【Code】10X301 【Course Year】Doctor Course 【Term】1st term 【Class day & 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 environemntal 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	5	
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	2	
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】

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Tailor-made lectures by supervisor

10X307

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 & 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	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Tailor-made lectures by supervisor

10X311

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 Disaster Risk Mitigation 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 Disaster Risk Mitigation Management	2	Urban Disaster Risk Mitigation Management
Urban Food/Water Supply Management	3	Urban Food/Water Supply Management
Urban Transport/Logistics Management	2	Urban Transport/Logistics 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】

10X315

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X317

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X321

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.

10X323

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X325

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

733103

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】

733104

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 Week10: Skills for sustainability communication and advocacy Week 11:Fieldwork
Ethics of water, agriculture and development	4	Week 12: Group presentaions Ⅰ Week 13: Group preparations Ⅱ Week 14: Group presentations Ⅲ 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
?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】

10X333

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】

10X335

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X337

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 & 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
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X339

Internship for Human Security Engineering

人間安全保障工学ｲﾝﾀｰﾝｼｯﾌﾟ

【Code】10X339 【Course Year】Doctor Course 【Term】1st+2nd term 【Class day & Period】 【Location】

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

【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】

Advanced Capstone Project

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【Code】10X341 【Course Year】Doctor Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】8 【Restriction】 【Lecture Form(s)】 【Language】English 【Instructor】

【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】

10X351

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
	1	Tutorial by Seting up of reseach problem, discussion, presentation, etc.
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【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】

10X352

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 & 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
	1	Tutorial by Seting up of reseach problem, discussion, presentation, etc.
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【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】

10W001

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 widelly 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】

10F065

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, Kisihida 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

10F067

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 restring forces are taken into account. Wind-induced vibration of a square prism (Galloping) 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

10F068

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】Check the handouts. Additional studies will also be instructed.

【Web Sites】

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

10F011

Computational Fluid Dynamics

数値流体力学

【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
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.
Feedback	1	Discuss the contents of all classes and assignments. The details will be introduced in the course.

【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】

10F261

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 & 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 thories 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】

10F100

Applied Hydrology
応用水文学

【Code】10F100 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

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

【Instructor】Hori(DPRI), Sumi(DPRI), S.Tanaka(DPRI), Takemon(DPRI), K.Tanaka(DPRI), Kantoush(DPRI)

【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 amd 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, wataer 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 Proceses	2	Modelling of land surface processes, Application of land surface model
Hydrological Measurements of Large River Basins	2	Design and management of hydrological measurement system in large river basins
Hydro-eco Systems	2	Ecohydrological management of habitats in river ecosystems, Ecohydrological management of biodiversity in wetland ecosystems
Presentation and Discussion	2	study and exersize for given 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】Review work based on handouts and report work for issues given in the classes are required.

【Web Sites】

【Additional Information】

10F103

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】C1-191
【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), T. SAYAMA(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	3	River environment and disaster management
Hydrological processes and water disaster predictions	2	Hydrological processes and water disaster predictions
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.

Lecture material for Coastal disasters due to tsunamis and storm surges
http://urx3.nu/t4sq
http://urx3.nu/t4sA
http://urx3.nu/t4sC
【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】No specific requirement for independent study. Collect information broadly regarding environment and disaster related topics.
【Web Sites】
【Additional Information】Contact Prof. Takara at <takara.kaoru.7v@kyoto-u.ac.jp> if you have any query.

10F106

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 explaned.
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】

10K016

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 valueproblems. 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 prous 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-soid two-phase materials	2	Motion, conservation of mass, balance of linear momeutum 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. Programing 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 numericalmethods

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10F238

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 & 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 & Sons, 1997.
R. Flanagan and G. Norman, Risk Management and Construction, Blackwell Science
V.M. Malhotra & N.J. Carino, CRC Handbook on Nondestructive Testing of Concrete, CRC Press, 1989.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Addtional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.
ohtsu.hiroyasu.6n@kyoto-u.ac.jp

10F405

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 depoits	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】

10F203

Public Finance

公共財政論

【Code】10F203 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th

【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】

10F223

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 valuated 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】

10F439

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 backgound, the actual situation, and the theory for quantitative risk analysis through practice of investigation and discusion 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 exampls, 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
Ｄevelopmental 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.

10F441

Water Quality Engineering

水環境工学

【Code】10F441 【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】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】

10F234

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, Koji Kosaka, Yasuhiro Asada

【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.
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).
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.
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】

10F454

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/English
【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	Lean 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	Lean 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】

10F446

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 & Period】Wed 2nd
【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese/English
【Instructor】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. Also, students make presentation and discussion on the related papers.
【Grading】Points are allocated for the quiz at every lectures, the presentation and discussion, report.
【Course Goals】
【Course Topics】

Theme	Class number of times	Description
Guidance, IPCC, Observation of a climate change	1	(Kurata)
Radiative forcing	1	(Kurata)
Greenhouse gas	1	(Kurata)
Carbon cycle and response of climate	1	(Kurata)
Impact of Climate Change	1	(Kurata)
Energy system and mitigation of climate change	1	(Kurata)
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	1	(Kurata)
Achievement test	1	
	1	

【Textbook】Handout
【Textbook(supplemental)】
【Prerequisite(s)】
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10A632

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	8	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	3	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】

10F456

New Environmental Engineering I, Advanced

新環境工学特論 I

【Code】10F456 【Course Year】Master and Doctor Course 【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 Treatment in China and Nutrient Removal	1.4	Wastewater Treatment Plant: Case Study in China, Biological Nutrient Removal (BNR) (Prof. Wen, Tsinghua University)
Wastewater Reuse	1.3	Wastewater Reuse & Disinfection (Tanaka)
Wastewater Treatment in Malaysia	1.4	History of Water Pollution in Malaysia (Prof. Ghufran, University of Malaya) Case studies of wastewater treatment plants design & operation (Prof. Nuruol, University of Malaya)
Anaerobic Treatment	1.3	Anaerobic Biological Treatment Technologies (Prof. Shaliza, University of Malaya)
Membrane Technology	1.3	Treatment Technologies (Practical & Advanced Technology I): Membrane Technology (MT) (Prof. Huang, Tsinghua University)
Advanced Oxidation Processes	1.3	Advanced Oxidation Processes (Prof. Zhang, Tsinghua University)
Student Presentation	1.4	Student Presentations /Discussions I (all)
Student Presentation	1.4	Student Presentations /Discussions II (all)
Student Presentation	1.4	Student Presentations /Discussions III (all)

【Textbook】Class handouts

【Textbook(supplemental)】Introduced in the classes

【Prerequisite(s)】General understanding of water environmental issues

【Independent Study Outside of Class】The students should study the PPT file used in the lectures. Students also need to enough literature review and related prior to their presentation.

【Web Sites】

【Additional Information】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.

10F458

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. 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
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 Enivironmental 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 & 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 (50%) and report subjects(50%) 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 bioassey	5	Qualitative analysis of organic compounds such as mass spectrometry, NMR, ESR and IR and bioassey 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】

10F113

Global Survivability Studies

グローバル生存学

【Code】10F113 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th
【Location】Yoshida, Higashi Ichijokan, Shishukan Hall 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture
【Language】English 【Instructor】Kaoru Takara, Junji Kiyono, Satoshi Fujii, Takahiro Sayama, Mika Shimizu
【Course Description】Modern global society is facing risks or social unrests that are caused by huge natural hazards and disasters, man-made disasters and accidents, regional environmental change/degradation including infectious diseases, and food security. Introducing such examples at global and regional scales, this subject lectures how to cope with them at national, local and community levels for making the society sustainable/survivable. Future countermeasures are also discussed under the uncertain circumstances such as climate change, population growth, energy and socio-economic issues.
【Grading】Attendance to lectures (40%) and Presentation and discussion (60 %).
【Course Goals】The objectives of this class are to have basic knowledge about global issues threatening safety and security of the earth society such as catastrophic natural disasters, man-made disasters and accidents, regional environmental change (including infectious diseases) and food security, and to enhance student ’ s ability to express his/her own ideas and discuss with professors and students from other study areas.
【Course Topics】

Theme	Class number of times	Description
Introduction of Global Survivability Studies	1	Introduction of Global Survivability Studies.
Earthquake disaster mitigation	1	Discuss on earthquake disaster mitigation focusing on lessons learnt from Tohoku EQ.
Mitigation of earthquake damage to historic structures	1	Discuss on the mitigation of earthquake damage to historic structures.
Why we need GSS?	1	Discuss on why we need Global Survivability Studies (GSS).
Global agendas for sustainable development and resilient societies	1	Discuss on global agendas for sustainable development and resilient societies.
Building national resilience in Japan	1	Discuss on building national resilience based on Japanese experiences.
Globalism as totalitarianism	1	Discuss on globalism as totalitarianism.
Public policy and systems approach for global changes in disaster risks	1	Lecture and group work on public policy and systems approach for global changes in disaster risks.
Disaster risk management and governance for global changes	1	Lecture and group work on disaster risk management and governance for global changes.
Water-related disaster risk management	1	Discuss on water-related disaster risk management: concept and recent experiences.
Water cycle and climate change	1	Discuss on water cycle and climate change.
Presentation by students & discussions	4	Presentation by students related to this lectures and discussions on the presented topics.

【Textbook】Nothing special.
【Textbook(supplemental)】Nothing special.
【Prerequisite(s)】Nothing special.
【Independent Study Outside of Class】If handouts (teaching materials) are distributed (or downloaded from the website), students should read them prior to the class. They may be distributed at the classroom (or put on the website). Students can make use of them after the class for reviewing lectures and preparing presentation materials and discussion sessions which will be organized in the latter half of the semester.
【Web Sites】
【Additional Information】This subject is compulsory for students enrolled in the Inter-Graduate School Program for Sustainable Development and Survivable Societies. Students other than ones in Graduate School of Engineering should submit a registration card for taking this class.

10K001

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 5th 【Location】A2-306 【Credits】First term: 2, Spring term: 1.5 【Restriction】No Restriction

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

【Instructor】GL Edu. Center, J. Assoc. Prof., Ryuichi Ashida
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】Requirements and a number of credits are different with the academic system students choose, the modified academic quarter system or the academic semester system. Students who choose the academic semester system must meet the requirements for the first 11 lectures and the latter 4 lectures separately.
When the students who choose the modified quarter system are graded, the average score of the best four reports is employed. When the students who choose the academic semester system are graded, the average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Materials Processing Using External Fields for Microstructure Control	1	Properties of materials are not simply determined by crystal structure and chemical composition. Microstructure (i.e. crystal grain size, crystallographic orientation) can significantly influence the properties. Materials processing for the microstructure control, using external fields will be demonstrated in this class. (H. Yasuda: Dept. of Materials Science and Engineering)
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. (Y. Nakao: Dept. of Material Chemistry)
Synthesis and Functions of Mixed Anion Compounds	1	As we entered the 21st century, mixed anion compounds, which contain several different anions, began to draw attention as new types of inorganic material. My lecture will show synthetic and functional aspects in this class of materials. (H. Kageyama: Dept. of Energy and Hydrocarbon Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
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. (T. Koga: Dept. of Polymer Chemistry)
Photonic Crystal Technology	1	Photonic crystals are materials with periodic modulation of refractive index, in which a frequency range that existence of photon is prohibited (i.e. photonic band gap) can be formed. In this class, basics and applications of photnic crystals are introduced. (T. Asano: Dept. of Electronic Science and Engineering)
Introduction to Nuclear Materials	1	Nuclear materials are designed for irradiation field of neutron and high-energy particles. Some topics of nuclear transmutation, thermonuclear fusion, boron neutron capture therapy and others will be talked. (I. Takagi: Dept. of Nuclear Engineering)
Application of Polymer Nanoparticles to Bio-Imaging	1	Polymers are widely used in various delivery/localization events as drug carriers, stabilizers of clinical protein and nucleic acid medications, and lesion targeters. An obvious merit of polymers with an appropriate (>10 nm) size is that they escape from facile renal excretion. The size has another significance in case of tumor targeting. Tumor tissues usually have defective endothelial cells with a wide opening and undeveloped lymphatic vessel, so that polymer nanoparticles of the size range of 10 － 100 nm can permeate into the tumor and are retained therein. This is the so-called enhanced permeability and retention (EPR) effect, which shows high performance in terms of selectivity and efficiency in bio-imaging. (T. Kondo: Dept. of Energy and Hydrocarbon Chemistry)
Radiation Induced Reactions towards 1 -Dimensional Nanomaterials	1	Whether can we produce nano-material by the reactions induced by a “ ray ” (ionizing radiation)? The answer is yes. With an use of an atomic particle accelerated up to MeV orders, the one particle provides a nanowire along its trajectory via condensed and efficient chemical reactions in organic media. Single particle Nanofabrication Technique (SPNT) or Single Particle Triggered Linear Polymerization (STLiP), referred as, are demonstrated as versatile methods to give low dimensional nanomaterials based on a variety of organic molecular systems in this lecture. (S. Seki: Dept. of Molecular Engineering)
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. (K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
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. (H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Designing Polymer Membrane Materials to Capture Green House Gases	1	We will discuss the overall obstacles involved in capturing green house gases such as CO2 or Methane, and the specific challenges to generating polymer membranes that can achieve it. Then we will consider how to design polymer materials that can overcome such obstacles. (E. Sivaniahi: Dept. of Molecular Engineering)
Oxide Magnetic Materials	1	The aim of the lecture is to review the fundamentals and applications of oxide magnetic materials. Main topics include fundamentals of magnetism, magnetic properties of oxides, magneto-optics of oxides, oxides for spintronics, and multiferroic oxides. (K. Tanaka: Dept. of Material Chemistry)
Force Acting on Colloidal Particles	1	Colloid means small particles dispersed in a liquid solvent. Theoretical approaches on several forces acting on colloidal particles such as thermal, hydrodynamic, and electrostatic forces will be discussed. (R. Yamamoto: Dept. of Chemical Engineering)
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. (K. Murase: Dept. of Materials Science and Engineering)

【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.

10K005

Advanced Modern Science and Technology（English lecture）

現代科学技術特論 (英語科目)

【Code】10K005 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th 【Location】A2-306 【Credits】2(Semester system) 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 GL Edu. Center, J. Assoc. Prof., Ryosuke Matsumoto
Related professors

【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】Students who choose the academic semester system must meet the requirements for the first 11 lecturers and the latter 4 lecturers separately.
When evaluating your grade, I employ the average score of best four reports for students who chose the modified quarter system, and best five reports for students who chose academic semester system.
Please go to KULASIS Web site. You can find an attachment file, ”通知版：2016 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
Exploration of Radiation Belts by Space Radio Engineering	1	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.(Y. Omura: Dept. of Electrical Engineering)
Functional Organic Molecular Materials for Molecular Scale Nanoscience	1	This lecture explains functional organic molecular materials with functions like photochromism or molecular conductance, which are expected to play an active role in molecular scale nanoscience.(K. Matsuda: Dept. of Synthetic Chemistry and Biological Chemistry)
Micro- and Nano-scale Separations in Analytical Chemistry	1	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.(K. Otsuka: Dept. of Material Chemistry)
Role of Nanoparticles Aiming at Theranostic Agents for Solid Cancers － Sustainable Universe Health Care in the Aged Society	1	Malignancy takes the first position for the cause of mortality in Japan. Realization of a “ society of health and longevity ” therefore requires a general method for diagnosis and therapy for cancers in the early stage. Nanoparticles are currently highly expected to this type of medicinal treatment, because nanoparticles can avoid expensive therapy, which would bankrupt our universal health care system.(S. Kimura: Dept. of Material Chemistry)
What are polymers?	1	What is a polymer? Also, what is the difference between polymers and other molecules? The characteristics of polymers and polymerizations are explained with some examples on practical applications of polymers.(M. Ouchi: Dept. of Polymer Chemistry)
Precision Polymerization and Functional Materials by Macromolecular Design	1	The methodology to synthesize polymers precisely and their features are described. In addition, some examples on functional materials using polymers whose molecular design is important are introduced.(M. Ouchi: Dept. of Polymer Chemistry)
Analysis and Design of Socio-Technical Systems	1	When introducing various kinds of automation systems including robots into a new work environment, it is necessary to design and analyze from the viewpoint of socio-technical systems, which is the interaction system of people, technology and organization. In this lecture, specific problems and solutions are described.(T. Sawaragi: Dept. of Mechanical Engineering and Science)
Computational Chemistry and computer science	1	Remarkable progress in the computer science has been revolutionizing scientific research and technological development for this decade. This trend will further accelerate in the future. This lecture reviews the impact of state of the art computer science on the molecular chemistry as an example.(R. Fukuda: Dept. of Molecular Engineering)
Photofunctional Single-Walled Carbon Nanotubes	1	Basic chemical properties of single-walled carbon nanotubes are introduced, and then applications of them as photofunctional molecular platform and charge transport pathway are presented. (T. Umeyama: Dept. of Molecular Engineering)
Renewable energies and rechargeable batteries	1	For the effective use of renewable energies,rechargeable batteries have been focused. Basic chemistry of batteries and how the rechargeable batteries are utilized for the storage of the energies will be given by the first lecture.(T. Abe: Energy and Hydrocarbon Chemistry)
Renewable energies and hydrogen production	1	Fuel cells using hydrogen are clean energy sources. The second lecture is about the hydrogen production based on the renewable energies.(T. Abe: Energy and Hydrocarbon Chemistry)
Genome sequences, what do they say and how can we use them?	1	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.(H. Atomi: Dept. of Synthetic Chemistry and Biological Chemistry)
Optical clocks -measurement of time at the 18th decimal place	1	Time or frequency is the most precisely measurable quantity. Clocks referenced to atomic resonances, called atomic clocks, have extremely small uncertainties. They realize the definition of second and are applied to the global positioning system (GPS). This lecture introduces atomic clocks based on lasers, which improve the uncertainty to be the 18th decimal place.(K. Sugiyama: Dept. of Electronic Science and Engineering)
Mechanism of particle electrification	1	The basic concepts and theories of charge transfer between solid surfaces are summarized and particle electrification caused by repeated impacts on a wall is formulated.(S. Matsusaka: Dept. of Chemical Engineering)
Control of electrostatic charge on particles	1	On the basis of the concepts and formulation on particle electrification, new methods for the control of electrostatic charge on particles are presented.(S. Matsusaka: Dept. of Chemical Engineering)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Students who take Autumn term should register Lecture code 10H006.

10X401

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】NAKAKOJI Kumiyo, MIURA Ken, KANKI Kiyoko, MAKI Norio

【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
	1	
	3	
	3	
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X402

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】Tetsuo Sawaragi, Kumiyo Nakakoji

【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. Especially, 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】Students will be evaluated based on the following criteria, in the order listed. (1) Exercises assigned in class: approx. 20% (2) Final exam: approx. 60% (3) Contributions to classwork (e.g., asking good questions): approx. 20%

【Course Goals】This course is aimed at developing the ability to apply methods for identifying problems and interactively analyzing/evaluating systems, based on understanding of the principles of artifact design and on systematic thinking.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	We will shed light on the concept of artifacts as something to be put on equal footing with natural objects and examine the history of artifacts in terms of how they were viewed in different ages?namely, artifacts as modes of representation in the ancient world, artifacts as necessities for survival in the middle ages, artifacts as forms of convenience in modern times, and artifacts as a means of perpetuation in the current era.
Artifact function and purpose	3	The effects that artifacts have on the outside world?i.e., other things?are “ functions. ” Function is the concept of questioning the existence of an artifact, and design is the formulation of functions for achieving an intended purpose. We will discuss the categorization of artifacts in terms of how the “ purpose ” of artifacts relates to the context in which they are used, and look at the origins of artifacts from the perspective of semiosis.
Artifact design principles	2	To understand an artifact is to know how its internal structure acts on the outside world to realize its function. Today, cybernetics?which has explored the interaction between the physical world and the world of information?is expanding into a concept that encompasses society as well (second-order cybernetics), and concepts have been put forward for actively rethinking how human cognition and decision-making interact with the outside world (ecological approaches, socially distributed cognition, naturalistic decision-making). We will examine artifact design principles based on theories related human activity at the boundary of these externalities.
Artifact design representation and evaluation	3	Design must fulfill its role of enhancing the quality of life through the creation of not only individual artifacts, but also environments and social systems that encompass groups of artifacts and natural objects. We will discuss the path toward expanding the scope of design from physical objects to environments and social systems that include intangible services, including with regard to problem development/representation methods, how to set purposes of design, how to eliminate the ambiguities and conflicts among various goals, searching for alternative design strategies, design evaluation, and principles and methods of consensus-forming among different stakeholders.
User-centered artifact design	2	The quality of designs is something to be evaluated by the user, and hence there must be collaboration between users and designers/producers. Moreover, complex design challenges cannot be resolved by experts of only one discipline; they must be tackled by pooling the design-related knowledge of different domains. We will discuss the concept of user-centered design, design rationale, and international standards of design processes for achieving design that is grounded in the user ’ s needs/perspective.
Participatory systems approach	2	In order to deal with the design of large-scale, complex artifacts, one must take the approach of systemically structuring problems and basing design on diverse perspectives. We will broadly examine: interactive processes among system designers, users, and computers; methods of structurally modeling problems through repeated dialogue between experts in relative disciplines and computers; and ways of supporting the perceptions, interpretations, and decision-making of designers and users. We will also consider the utility of the participatory systems approach in smooth, effective implementation of system design.
Exercise in participatory systems approach	2	Students will apply the participatory systems approach to a real-world artifact design challenge, and report the results of this exercise.

【Textbook】Lecture notes used in class will be distributed as needed. Refer to “ Textbook (supplemental) ” below.

【Textbook(supplemental)】1. 吉川弘之 [2007] 人工物観 , 横幹 , 1(2), 59-65 2. Suh, N.P. [1990] The Principles of Design, Oxford University Press （邦訳：スー (翻訳：畑村洋太郎)「設計の原理？創造的機械設計論」, 朝倉書店 , 1992.） 3. 吉川弘之 [1979] 一般設計学序説 , 精密機械 45 (8) 20?26, 1979. 4. Vladimir Hubka and W. Ernst Eder [1995] Design Science, Springer 5. Simon,H.[1996] The Sciences of the Artificial Third edition 秋葉元吉、吉原英樹訳 [1999]『システムの科学』パーソナルメディア 6. H・A・サイモン [1979] 稲葉元吉・倉井武夫訳 , 『意思決定の科学』, 産業能率大学出版部 7. Hutchins, Edwin [1995] Cognition in the Wild. MIT Press 8. Klein, G., Orasanu, J., Calderwood, R., and Zsambok, C.E. [1993] Decision Making in Action: Models and Methods. Ablex Publishing Co., Norwood, NJ. 9. D・ノーマン [1986] The Design of Everyday Things, 野島久雄訳『誰のためのデザイン？：認知科学者のデザイン原論』、新曜社 10. 椹木、河村 [1981]：参加型システムズ・アプローチ―手法と応用、日刊工業新聞社ほか

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Office hours will be held for one hour before and after each class period (preferably 5th period on Tuesdays, but also 3rd period on Wednesdays). Appointments for other times can be requested by e-mail.

698541

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	
	2	
	3	
	3	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X403

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 2nd

【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
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

698542

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】C3-Lecture Room 4a 【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
	3	
	4	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

698543

デザイン構成論

【Code】698543 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th

【Location】C3-Lecture Room 4a 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X411

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 & Period】Fri 3rd

【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
	2	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G013

Dynamic Systems Control Theory

動的システム制御論

【Code】10G013 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10G011

Design and Manufacturing Engineering

設計生産論

【Code】10G011 【Course Year】Master Course 【Term】1st term 【Class day & 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 & 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】

10Q807

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】

10G057

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.Bussiness 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

10G403

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】

10G001

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 (four home works will be assigned) 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
Linear system	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	2	Interpolation and its errors
Numerical integra l	2	Numerical integration methods
Normal differential equation and numerical integral	1	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 distributed through the course website.

【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 LibreOffice (OpenOffice).

【Web Sites】Lecture notes, home works, and other info will be distributed through PandA:
https://panda.ecs.kyoto-u.ac.jp

【Additional Information】Have a PC with Microsoft Excel with VBA or LibreOffice (https://ja.libreoffice.org/). Apache OpenOffice(http://www.openoffice.org/ja/) wil be also ok.

10C430

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 2nd

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

【Instructor】Kei Senda, Sinya Aoi

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

【Grading】Evaluation depends on marks of examination (80%) and exercises (20%). Both marks should be 60% or better.

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

【Course Topics】

Theme	Class number of times	Description
Analytical Mechanics	7	1. Newton equations, 2. Lagrange equations, 3. Hamilton equations
Orbital Mechamics	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】

10V202

Introduction to the Design and Implementation of Micro-Systems
微小電気機械創製学

【Code】10V202 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 4th

【Location】C3-Lecture Room 1 【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
	3	
	2	
	3	
	2	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G025

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 & Period】Wed 3rd

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

【Language】Japanese 【Instructor】Masaharu Komori

【Course Description】For any machines, prime movers and powertrains are necessary to realize the required functions. In automobiles, an engine is the prime mover and a transmission, a clutch, and a shaft are parts of the powertrain. In machine tools, a motor is used as the prime mover and the powertrain uses feed screws. In this lecture, the prime mover is taken up. Types, characteristics, principles, advantages and disadvantages of the prime mover are explained. In addition, examples of the powertrains are shown using mechanism models.

【Grading】Evaluate comprehensively by participation in class, tests, reports, etc.

【Course Goals】Understand the principles and basic characteristics of the prime movers and powertrains taken up in the lecture.

【Course Topics】

Theme	Class number of times	Description
Outline	1	Outline of mechanical functional device engineering, composition of mechanical device, examples of prime movers, working parts, and powertrains, examples of actuators and mechanisms
Electromagnetic force	3	Principle used for actuators, type of electromagnetic motor, principle and characteristics of synchronous motor, generating method of rotating magnetic field, induction motor, reluctance motor, DC motor, stepping motor
Electrostatic force	1	Usage as actuator, explanation of principle and characteristics
Piezoelectric	1	Piezoelectric effect, characteristics of piezoelectric effect, piezoelectric material, polarization, displacement and force, hysteresis, type and basic structure, application
Fluid pressure	1	Fluid pressure actuator
Ultrasonic	1	Ultrasonic motor
Shape memory alloy	1	Shape memory effect, shape resilience
Mechanism	5	Introduction of mechanism using mechanism model
Feedback class	1	Answer questions

【Textbook】Instruct as necessary.

【Textbook(supplemental)】Instruct as necessary.

【Prerequisite(s)】Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Schedule of lecture may be changed according to circumstances. Supplement in English as necessary.

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 foreing 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 annouced 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 2017.

10X412

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】Kiyoshi TAKEYAMA, Kiyoko KANKI, Akihisa HIRATA

【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 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 advanced design projects as case studies, together with the designers.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction -- Overall VIews for Case Studies	2	
Case Study -1	4	
Case Study -2	4	
Case Study -3	4	
Summarizing Discussions	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X413

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 & 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】

10X414

Theory of Architectural and Environmental Planning
建築環境計画論

【Code】10X414 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 2nd 【Location】C2-102 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】

【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	3	
Development of Townscape Semiotics	2	
Creative Regeneration of Townscape in Historical City Kyoto	2	
System Theory of Designa and Evaluation of Living Environment	2	
Development of Design Methodology	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B035

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 & 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】

10B024

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 & 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	
	3	
	3	
	3	
	5	

【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 & 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
	3	
	2	
	2	
	2	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B037

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
	1	
	1	
	1	
	1	
	1	
	1	
	1	
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 vatiations 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 & 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	
	5	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B046

Dynamic Response of Building Structures
建築振動論

【Code】10B046 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 1st

【Location】C2-102 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Y.HAYASHI, Y.Ohnishi, K.Nishijima

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	2	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B241

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,Shinichi 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 lessens 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
Mechanism of disasters by earthquakes	4	What is urban disaster management? Mechanism of disasters by earthquakes, source mechanisms for disastrous earthquakes in and around Japan, ground motion generation process, seismic intensity and magnitude, characteristics of observed ground motion will be explained from previous earthquake disasters.
Basics of wave propagation and strong ground motion	3	Wave propagation analysis and strong motion simulation
Structural response estimation	3	Modeling of structures and prediction of their responses
Environmental impact by great eartuquake 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)】Earthquake Ground Motion and Strong Motion Prediction - Key items for learning the basics - (AIJ)
Ground motion - phenomena and theory (AIJ)
Vibration of Architecture (Asakura Publishing)
【Prerequisite(s)】Basic knowledge of seismic design and earthquake resistant structure
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10B222

Environmental Control Engineering, Adv.

環境制御工学特論

【Code】10B222 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 3rd

【Location】C2-102 【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】

Theme	Class number of times	Description
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 archivements	1	Evaluation of archivements 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】Questions will be accepted at occasions via Email.

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 & 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	
	3	
	3	
	6	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693547

Industrial mathematics and design
数理とデザイン

【Code】693547 【Course Year】Doctor Course 【Term】2nd term 【Class day & 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	
	3	
	3	
	1	
	3	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693164

Pattern Recognition, Adv.
パターン認識特論

【Code】693164 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】

【Credits】2 【Restriction】No 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
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693125

Language Information Processing, Adv.
言語情報処理特論

【Code】693125 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No 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
	1	
	2	
	2	
	2	
	2	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X431

Introduction to Algorithms and Informatics

アルゴリズム論

【Code】10X431 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】

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

【Course Description】This is an introductory course on algorithms and informatics for students with no prior knowledge of the subject matter. The course content will include a look at the early history of algorithms, how computers store data (image, sound, and video), privacy and security issues, web design and algorithms, algorithms for optimization, data mining, and machine learning. Along the way, we will consider a broad variety of algorithms which have had a major impact on computing, including many of the celebrated Top 10 Algorithms of the 20th Century, chosen by the editors of Computers in Science and Engineering.

【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】

693625

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 & Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No 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	
	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】No 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	
	4	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693541

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 & 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
	7	
	7	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693422

Optimization Theory, Advanced
最適化数理特論

【Code】693422 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Thu 2nd 【Location】

【Credits】2 【Restriction】No 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	
	4	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693168

Conversational informatics

Conversational informatics

【Code】693168 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】

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

【Course Description】Conversational interaction is considered to be a powerful communication means for intelligent actors, either natural or artificial, to interact each other to act as a collective intelligence. In this course, we study the mechanism of conversational interactions with verbal and nonverbal cues from computational points of view and discuss key issues in designing conversational systems that can interact with people in a conversational fashion.

【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】

693419

Control Systems Theory, Advanced
制御システム特論

【Code】693419 【Course Year】Doctor Course 【Term】2nd term 【Class day & 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
	4	
	2	
	2	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693536

Statistical Systems Theory
統計的システム論

【Code】693536 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】Integrated Research Bldg.-111 【Credits】2 【Restriction】No 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
	1	
	1	
	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】

693517

Theory of Symbiotic Systems
統合動的システム論

【Code】693517 【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	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

693247

Social Informatics
情報社会論

【Code】693247 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【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
	2	
	2	
	3	
	4	
	4	

【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】No 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】

693628

Information Network

情報ネットワーク

【Code】693628 【Course Year】Doctor Course 【Term】1st term 【Class day & 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
	2	
	5	
	3	
	1	
	1	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】http://www.i.kyoto-u.ac.jp/curriculum/syllabus.html

10X433

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】 【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
	3	
	1	
	2	
	2	
	2	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X434

Designs for Emergency Management

防災・減災デザイン論

【Code】10X434 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Mon 3rd

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

【Language】Japanese 【Instructor】,,,

【Course Description】Damage from disasters is defined by two factors: scale of hazard and social vulnerability. Two strategies exist to reduce damage from disasters - namely, crisis management as a post-event countermeasure and risk management as a pre-event measure. This course introduces students to a system for effective emergency management, consisting of response, recovery, mitigation, and preparedness.

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X436

Computational Learning Theory

計算論的学習理論

【Code】10X436 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 1st 【Location】

【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
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X438

Statistical Learning Theory
統計的学習理論

【Code】10X438 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Mon 1st 【Location】

【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
	4	
	6	
	5	

【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】Doctor Course 【Term】2nd term 【Class day & Period】Thu 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	
	3	
	1	
	1	
	2	
	1	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X442

Distributed Information Systems
分散情報システム

【Code】10X442 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 3rd 【Location】

【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
	10	
	5	

【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】Doctor Course 【Term】1st term 【Class day & Period】Thu 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
	3	
	4	
	3	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X451

Design Ethnography

デザインエスノグラフィ

【Code】10X451 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】

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

【Course Description】Ethnography is seen as one of the key methods for design. At minimum, designers need to understand the field in which they are to introduce their designs. For this, it is not enough to ask people; it is necessary to gain a first-hand understanding through experiencing the lives in the field. Through ethnography, designers can grasp taken-for-granted experiences and start to look at their problems from a fresh perspective. In this course, students will learn the basics of ethnography (e.g., how to write fieldnotes, how to make observations and how to analyze the data) and develop their skills through group projects. This course focuses on the ethnography part of design although in reality it cannot be separated from the rest of the design. Students are encouraged to take other courses on design so that they can fully exploit the insights gained through ethnography.

【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	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X452

Business Design

事業デザイン論

【Code】10X452 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No 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
	1	
	10	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X453

Design Management
デザイン経営論

【Code】10X453 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No 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】

10X454

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 & Period】Fri 3rd 【Location】

【Credits】2 【Restriction】No 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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X455

Service Innovation Management

サービス経営論

【Code】10X455 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 5th 【Location】

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

【Course Description】Designing value creation from the viewpoint of service dominant logic is increasingly important for any business. The purpose of this course is to educate students to become a part of the Service Creative Class, where they acquire the capabilities of deeply understanding human behaviors, extracting the vital economic and social values through the combined knowledge of the natural and social sciences. In order to pursue such design capabilities, various kinds of interdisciplinary knowledge are required. In this course, we will focus on key service innovation management. The components that are included in this course are; service marketing, human resource management, service strategies, service accounting service hospitality, IT service management, and applications to several vertical domains as public services or professional services. The course is provided by a series of omnibus style lectures. Those who wish to work for global businesses, business development for high-tech industries, start-ups, service design management, etc. in the context of knowledge and servicizing economy, are welcome to enroll.

【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】

Marketing Research

マーケティングリサーチ

【Code】10X456 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】English 【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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X461

Cognitive Theory of Design

認知デザイン特論

【Code】10X461 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Thu 1st 【Location】

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

【Course Description】Cognitive psychology posits that the human activities involved in the design process can be grasped by examining the brain, mind, and behavior. The objective of this course is to encourage comprehensive discussions of design based on cognitive psychology theory. First, we will gain a better understanding of how the brain, the mind, and behavior are designed. Second, we will discuss their respective constraints and explore the relationships that exist between those constraints and the rich cognitive activity that results when we turn constraints into advantages. Third, we will examine examples drawn from literature, art, and music that will serve as the basis for discussions about the relationships that exist among the functions of the brain, the mind, and behavior. We will also examine the rich designs each function can produce. Finally, to improve students ’ abilities to produce rich designs, we will discuss various environmental factors to encourage the development and activation of our own brains, minds, and behaviors.

【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	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X462

Seminar on Psychology and Design Studies Ⅰ

心理システムデザイン演習Ⅰ

【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】

10X463

Seminar on Psychology and Design Studies Ⅱ

心理システムデザイン演習Ⅱ

【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	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X464

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】

10X465

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】Japanese 【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】

10X466

Advanced Studies: Cognitive Sciences

デザイン心理学特論

【Code】10X466 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

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

【Course Description】Language divides the world by the use of symbols known as words. However, how do children learn to use language? How do children change as they acquire language? How dependent is thought on language? How does thought differ among speakers of different languages? In this course, students will consider the following questions by engaging in experimental research in cognitive science: (1) what are the processes involved in child language acquisition; (2) what are the processes involved in the development of concepts; (3) what kinds of relationships exist between language and concept learning; and (4) what kinds of relationships exist between language and thought?

【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】

10X467

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 2nd 【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 & 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】

10X472

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 & 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】

10X474

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】

10X475

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 & 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】

10X476

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 reserch 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 I

【Code】10X481 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】4 【Restriction】No 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】

10X482

Design Science Exercise, Adv. 2
デザイン学特別演習Ⅱ

【Code】10X482 【Course Year】Master Course 【Term】1st+2nd term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

698561

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】No 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
	５日間程度・集中講義	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

698562

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 & Period】

【Location】【Credits】1 【Restriction】No 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	Class number of times	Description
	7～9日間程度・集中講義	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Informatics Practice I
情報学演習Ｉ

【Code】698581 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese 【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	
	1	
	13	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

698582

Informatics Practice II
情報学演習II

【Code】698582 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【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
	1	
	1	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X491

Advanced Studies: Research Methods in Psychology and Design Studies

心理デザイン研究法特論

【Code】10X491 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 4th

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

【Course Description】The goal of this course is for students to acquire skills required to convey research results in a precise and efficient manner by the use of quantitative data drawn from fields such as design study, psychology, and pedagogy. Students will deepen their understanding of useful and advanced statistical methods employed in the conduct of empirical research and the testing of hypotheses. They will learn to apply these methods to their own research. The course will provide an outline of statistical methods and introduce statistical mechanisms. It will teach students the proper use of these methods based on examinations of research examples. Students will conduct literature reviews to discover studies that employ these methods in their investigations. Students will examine and discuss these studies on several occasions.

【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	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X492

Seminar on Research Methods in Psychology and Design Studies

心理デザイン研究法演習

【Code】10X492 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

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

【Instructor】,

【Course Description】This course has three objectives: (1) students will consider system design at various levels from the perspective of psychology, (2) students will build a foundation that will help them conduct psychological experiments and surveys to examine a variety of research ideas, and (3) students will gain a better understanding of basic statistical methods required to test hypotheses by the use of psychological data. The following themes will be covered in a seminar format: methodology in psychology research; comparisons of various methods, characteristics, and processes involved in data collection; theories of and methods employed in psychological experiments and quasi-experiments; and the basic statistics used to test hypotheses and replicate previous findings.

【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	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X490

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】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3days	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X493

Management Research Methodology
経営研究方法論

【Code】10X493 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【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
	15	

【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】Master and Doctor Course 【Term】2nd term 【Class day & 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
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H636

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 & 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】

10V201

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 Electromechical 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.
Evatuation 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 provoded 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 & 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】Micro/nano fabrication processes and materials used to realize micro/nano systems are described. Topics will be photolithography, dry-etching, thin-film deposition, which includes bulk micro machining, surface micro machining and further advanced polymer processing.

【Grading】Evaluated by homework. All report must be submitted to obtain credits.

【Course Goals】To obtain fundamental knowledge about design and fabrication of micro/nano systems and to be familiar with recent fabrication technologies and micro/nano systems.

【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	
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G209

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 & Period】Mon 1st

【Location】C3-Lecture Room 3 【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】

10W603

Introduction to Biomedical Engineering
医工学基礎

【Code】10W603 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】Intensive lecture using 3 days on Saturdays since mid-June 【Location】Katsura

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

【Instructor】,,,

【Course Description】Understand basic concepts related to clinical medicine and medical engineering. And expand the range of research by exchange each engineering knowledge and experience.

【Grading】Participate to the workshops submit a report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to medicine for engineering students	3	
Introduction to Medical Engineeri	4	
Cross-field workshop	8	

【Textbook】no

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10G041

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】

10G205

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 eveolved 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 analysys system	4	Chemical analysis system and bio-sensing device using microsytem.

【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.

10C070

Introduction to Quantum Science

基礎量子科学

【Code】10C070 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10C072

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 & 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】

10H649

Polymer Synthesis

高分子合成

【Code】10H649 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 2nd

【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
	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】

10H652

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, Mikihito 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】

10H610

Reactive Polymers

反応性高分子

【Code】10H610 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 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	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【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】2nd term 【Class day & Period】Thu 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】H. Ohkita

【Course Description】In this class, optoelectronic 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 applications, which include optical fibers, organic light-emitting diode, and organic solar cells.

【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	3	
Photofunctional Polymers	3	
Optoelectronic Polymers	4	

【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 chemisty course for undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H611

Biomacromolecular Science

生体機能高分子

【Code】10H611 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【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
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H633

Biomaterials Science and Engineering

高分子医工学

【Code】10H633 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H021

Engineering for Chemical Materials Processing

化学材料プロセス工学

【Code】10H021 【Course Year】Master and Doctor Course 【Term】Spring 【Class day & Period】Wed 4th 【Location】A2-302
【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
【Instructor】Dept. of Chemical Engineering, Prof. M.Ohshima
,Dept of Chemical Engineering, Associate Prof. S.Nagamine,
【Course Description】Focusing on transport phenomena (flow & rheology, mass flux, heat flux) in polymer processing process, the key relationships among polymer properties, processing schemes, and processing machine are taught.
【Grading】40% midterm quiz, 60% exam at end
【Course Goals】The objective of this course is to know how the polymers are different in terms of thermal, rheological and mechanical properties. The attendees learn what Tg, Tc, Tm, G' and G are, how those properties can be measured and how these obtained measurement data can be appreciated. Visual Observation movies relates those properties with the transport phenomena that occur in several polymer processing processes.
【Course Topics】

Theme	Class number of times	Description
Orientation & Introduction of Polymer Processing	1	The characteristics of polymers are reviewed by exercising the characterization of general polymers, like PE, PP, PLA, PC, PS, PVC in terms of appearance, thermal and mechanical properties.
State of Thermoplastic Polymer	1	The relationship among pressure-volume-temperature of thermoplastic polymer is described. The way of identifying the Tg, Tc is taught. Several equations of state are introduced.
Thermal Properties of Thermoplastic Polymers	2	Several important thermal properties of thermoplastic polymers, such as glass transition temp, Tg, crystallization temp, Tc, and melting temp, Tm are explained together with the measurement methods of those thermal properties. The latest measurement device, Flash DSC, is introduced with some of the interesting data of crystallization process.
Rheological Properties of Thermoplastic Polymers	2	The basic of polymer rheology, viscosity and elasticity, is given. Several phenomena of non-Newtonian fluid are introduced. The fundamental constitutive equations, Maxwell and Voigt models, describing the viscoelasticity of the polymers are explained. Exercising on identification of polymer structures, such as the degree of entanglement, molecular weight, presence of long-chain branch from the rheological data, relationship between polymer rheology and polymer structure is explained.
Basic Flows in Polymer Processing	1	The basics of Polymer Processing are the series of Melt, Flow and Shape. Here the class focus on the Flow. The two types flow, i.e., drag and pressure flows are explained together with master equation. Without solving the mathematical equations, the skill of estimating the velocity profile is cultivated.
Visual Observation of Flow Phenomena in Processing Machine	1	Entertaining several visual observation movies showing the flow phenomena in real polymer processing machine like injection molding machine and extruder, The effects of thermal and rheological properties of polymer on those flow phenomena are clarified.
Phase separation and Morphology Formation	2	The basic of phase separation of polymer-polymer, polymer-solvent are taught.
Phase Separation Phenomena in Polymer Processing	1	Several polymer processing schemes exploiting a phase separation phenomenon are introduced. Synergistic design of the polymer properties, processing scheme and processing machine is stressed.
Check what we learn	1	During the class, plenty of quiz are given to check the understanding.

【Textbook】Handout
【Textbook(supplemental)】Agassant, J.F., Polymer Processing: Principles and Modeling
【Prerequisite(s)】Basic of Transport Phenomena
【Independent Study Outside of Class】
【Web Sites】
【Additional Information】

10H007

Chemistry of Polymer Materials

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day & 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
physical properties of polymers	3	physical properties of polymers
structure and physics of high-performance polymers	3	structure and physics of high-performance polymers
molecular design and function of functional polymers	6	molecular design and function of functional polymers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H031

Chemistry of Biomaterials
生体材料化学

【Code】10H031 【Course Year】Master Course 【Term】 【Class day & 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
biological functions in light of biomaterials	6	
cross-talk of polysaccharide with living systems	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H010

Chemistry of Functional Materials
機能材料化学

【Code】10H010 【Course Year】Master Course 【Term】 【Class day & Period】Wed 1st 【Location】A2-302

【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	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10S022

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 & 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】

Advanced Biomedical Engineering
先端医工学

【Code】10H209 【Course Year】Master and Doctor Course 【Term】【Class day & 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	
	3	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【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】1st 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】

10H815

Biorecognics
生体認識化学

【Code】10H815 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H813

Bioorganic Chemistry
生物有機化学

【Code】10H813 【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】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H816

Microbiology and Biotechnology

生物工学

【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】

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】

10H818

Advanced Organic Chemistry
先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】1st term 【Class day & 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】

Theme	Class number of times	Description
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Rections
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	2	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10H836

Advanced Biological Chemistry
先端生物化学

【Code】10H836 【Course Year】Master Course 【Term】1st term 【Class day & 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】

10P836

Advanced Biological Chemistry 2 Continued
先端生物化学続論

【Code】10P836 【Course Year】Master Course 【Term】 【Class day & 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 & 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】

10V003

Biomechanics

バイオメカニクス

【Code】10V003 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10B407

Robotics
ロボティクス

【Code】10B407 【Course Year】Master Course 【Term】2nd term 【Class day & 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 & 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】

10H002

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】Department of Chemical Engineering, Professor, 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	3	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】This is an biennial course which will be open in 2016, 2018, 2020, ...

10H003

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】Department of Chemical Engineering, Professor, 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	3	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】

10H202

Green and Sustainable Chemistry

物質環境化学

【Code】10H202 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Mon 2nd

【Location】A2-303 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】K.Ohe,Y.Tsuji,T.Sakka,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	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】

10X601

Mechanics and Dynamics, Fundamental
機械工学基礎

【Code】10X601 【Course Year】Master Course 【Term】1st term 【Class day & 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
	1	
	2-3	
	4-5	
	6-7	
	8-9	
	10-11	
	12	
	１３	
	１４	
	１５	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X602

Continuum Mechanics(Integrated Medical Engineering)

連続体力学（総合医療）

【Code】10X602 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】 【Credits】 【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	
	6-7	
	8-9	
	10-11	
	12-13	
	14-15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X603

Medical Electronics

医用電子工学

【Code】10X603 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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
	1-2	
	3-4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12-13	
	14-15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X604

Basic Material Chemistry

材料化学基礎

【Code】10X604 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd

【Location】A2-308 【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	
	4-6	
	7-8	
	9-11	
	12-13	
	14	

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

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-6	
	7-9	
	10-13	
	14-15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X606

Image Processing Basics

画像処理の基礎

【Code】10X606 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 1st

【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】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】

10X607

Biopharmaceutics

薬物動態学

【Code】10X607 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd

【Location】 【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	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14-15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X608

Human Anatomy
人体解剖学

【Code】10X608 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】5 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-15	
	1-12	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X609

Physiology(Integrated Medical Engineering)
生理学（総合医療）

【Code】10X609 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X610

Medical Chemistry

医化学

【Code】10X610 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X611

Geriatrics, Gerontology, and Aging Science
加齢医学

【Code】10X611 【Course Year】Master Course 【Term】1st term 【Class day & Period】 【Location】

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

10X613

Medical Ethics

医療倫理

【Code】10X613 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	6	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X614

Introduction to numerical simulation
シミュレーション概論

【Code】10X614 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 4th

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X615

Health Economics

医療経済論

【Code】10X615 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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】

10X616

Intellectual Property & Global Standardization

知的財産＆国際標準化

【Code】10X616 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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
	1	
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	13	
	14	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X617

Genome cohort study
ゲノムコホート研究

【Code】10X617 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd

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

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X618

Regenerative Medicine
再生医学

【Code】10X618 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】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】

10X631

Medical Engineering for Society I
医療工学特別講義Ⅰ

【Code】10X631 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & 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
	1	
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X632

Medical Engineering for Society II

医療工学特別講義Ⅱ

【Code】10X632 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & 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
	1	
	2	
	3	
	4	
	5	
	6	
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【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X700

Diagnostic Pathology : lecture
病理画像診断学：講義

【Code】10X700 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	3	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X701

Radiology・MRI introduction : lecture

放射線画像診断学・MRI 画像診断学：講義

【Code】10X701 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

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

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X702

Minimally invasive therapeutics: lecture

低侵襲治療学：講義

【Code】10X702 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	5	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X703

Biomaterials and Artificial Organs: lecture
生体材料学・人工臓器学：講義

【Code】10X703 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Lecture 【Language】 【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】

Medical informatics : lecture

医療情報学：講義

【Code】10X704 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	

【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】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【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	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X706

Medical and life support systems : lecture

医療・生活支援システム学：講義

【Code】10X706 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】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】

10X707

Diagnostic Pathology: practice
病理画像診断学：実習

【Code】10X707 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X708

Radiology・MRI introduction:practice

放射線画像診断学・MRI 画像診断学：実習

【Code】10X708 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	1	
	2	
	3	
	4	

【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】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
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	3	
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	5	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X710

Biomaterials and Artificial Organs: practice

生体材料学・人工臓器学：実習

【Code】10X710 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】 【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】

10X711

Medical informatics: practice

医療情報学：実習

【Code】10X711 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X712

Inspection equipment studies Science research equipment: practice

検査機器学・研究機器学：実習

【Code】10X712 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Exercise 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
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	5	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X713

Medical and life support systems: practice
医療・生活支援システム学：実習

【Code】10X713 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】 【Lecture Form(s)】Exercise 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

10X641

debate I

英語 debate Ⅰ

【Code】10X641 【Course Year】 【Term】 【Class day & Period】 【Location】 【Credits】2 【Restriction】

【Lecture Form(s)】 【Language】 【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】

10X642

debate Ⅱ

英語 debate Ⅱ

【Code】10X642 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

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

10X671

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】Master Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】4 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【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】

10X672

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】Master Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】4 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【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】

10X681

Integrated Medical Engineering Seminar A

総合医療工学分野セミナーＡ (修士）

【Code】10X681 【Course Year】Master Course 【Term】1st term 【Class day & Period】 【Location】

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

Integrated Medical Engineering Seminar B
総合医療工学分野セミナーＢ(修士）

【Code】10X682 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

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

10X683

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】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

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

10X684

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】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

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

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】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

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

10X686

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】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

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

工学研究科シラバス 2017 年度版
（[D] Interdisciplinary Engineering Course Program）

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編集者　京都大学工学部教務課
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・[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/

本文中の下線はリンクを示しています．リンク先はオンライン版を参照してください．

オンライン版の教科書・参考書欄には 京都大学蔵書検索 (KULINE) へのリンクが含まれています．

京都大学工学研究科 2017.4