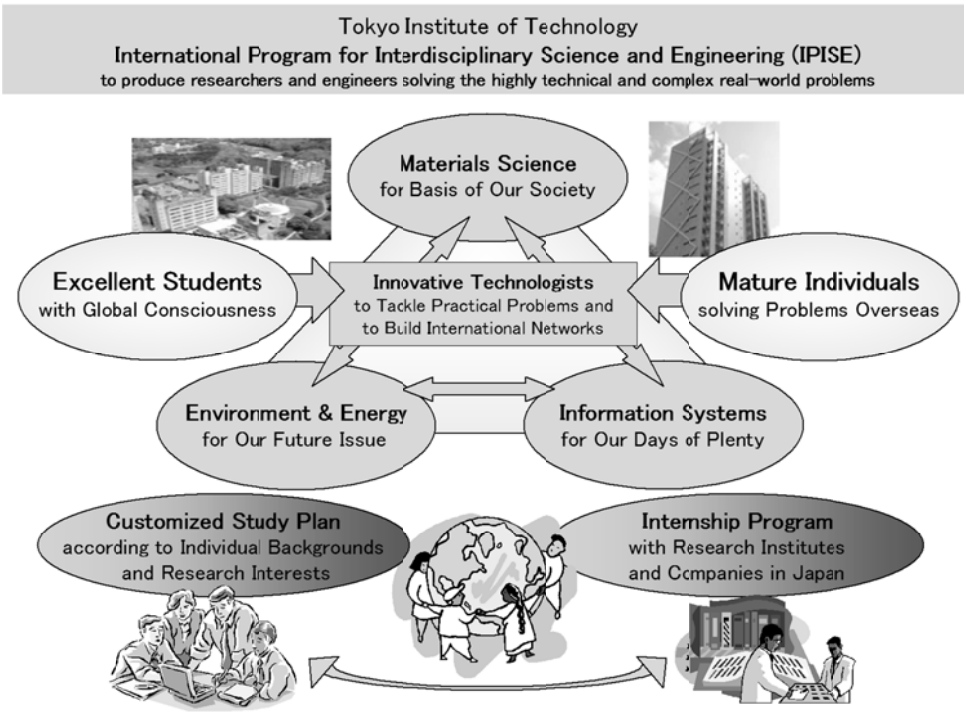
◆International Program for Interdisciplinary Science and Engineering (IPISE)

1. Outline of the Program

This graduate program is designed to produce researchers and engineers capable of solving the highly technical and complex real-world problems relating to materials, the environment, and information, through science and engineering. The independent graduate school that offers this program emphasizes interdisciplinary and creative education and research. In pace with the progress of globalization, the program accepts students from all over the world especially mature individuals with experience in solving problems overseas. The program offers these students a flexible and carefully designed course of education that can be finely customized according to their individual academic backgrounds and research interests, as well as the opportunity for exchange with Japanese students through tuition, and for internships with international research institutes and companies in Japan. The program is geared to producing innovative technologists equipped to tackle practical problems and to build multilateral international networks among them.



2. Course Descriptions

The IPISE was established in 2007 and renewed in 2013 in the Interdisciplinary Graduate School of Science and Engineering, which consists of 11 departments. In the IPISE, there are three advanced courses which are composed of the departments in the fields of Materials Science, Environment & Energy, and Information Systems. The enrolled student officially belongs to one of these 11 departments according to his/her supervisor, and learns under the curriculum offered by the department.

1. Advanced Course of Materials Science and Engineering

The course consists of the following 3 departments.

- Department of Innovative and Engineered Materials (IEM)*

- Department of Electronic Chemistry (ECHEM)*
- Department of Materials Science and Engineering (MSE)*

*( ) is Department code used in IPISE lecture title.

The three departments are at the forefront of research not only in Japan, but worldwide, in a wide range of fields, from basic research in the chemistry of organic, inorganic, metallic, and composite materials, to the development of high-performance materials. They aim to exploit the science and engineering of the near future, in particular future-oriented electronics, to contribute to the construction of a safe, secure, and sustainable society. It is necessary to pass the results of this materials research rapidly and efficiently to the international community. Also, due to the expected standardization and mobility of global-scale universities and graduate schools in the near future, pioneering work is vital in this field.

2. Advanced Course of Environmental and Energy Science and Engineering

The course consists of the following 4 departments.

- Department of Environmental Science and Technology (DEPE)*
- Department of Built Environment (ENVENG)*
- Department of Energy Sciences (DES)*
- Department of Environmental Chemistry and Engineering (CHEMENV)*

*( ) is Department code used in IPISE lecture title.

Science and technology is expected to make a contribution to the common global issues that must be addressed in order to construct a sustainable society - namely environmental problems, natural disaster threats, and energy problems. Because the nature of these problems, their conditions of occurrence, and the means for solving them vary from place to place, there is a vital need for innovative technologists who can conduct probing research into specific cases to seeks solutions. Positioning these highly individual phenomena into the generalized knowledge system of science is both extremely labor-intensive and time consuming. For this reason, compared with other more highly abstract fields of science, often the results of research efforts cannot be always be successfully applied. In this course, the technologists placed in this position are taken up as a major subject of study.

3. Advanced Course of Information Technology and System Sciences

The course consists of the following 4 departments.

- Department of Electronics and Applied Physics (E&AP)*
- Department of Mechano-Micro Engineering (MECMIC)*
- Department of Computational Intelligence and Systems Science (CISS)*
- Department of Information Processing (IP)*

*( ) is Department code used in IPISE lecture title.

The Information and Systems group is targeted at high achievers from leading universities in developing countries, or universities with which Tokyo Tech has cooperative agreements, and covers leading-edge, innovative, practical, and original fields of research in intelligent computing and data communications. The course aims to cultivate world-leading individuals who will promote exchange between Japan and international researchers and technologists when they return home after completing their studies.

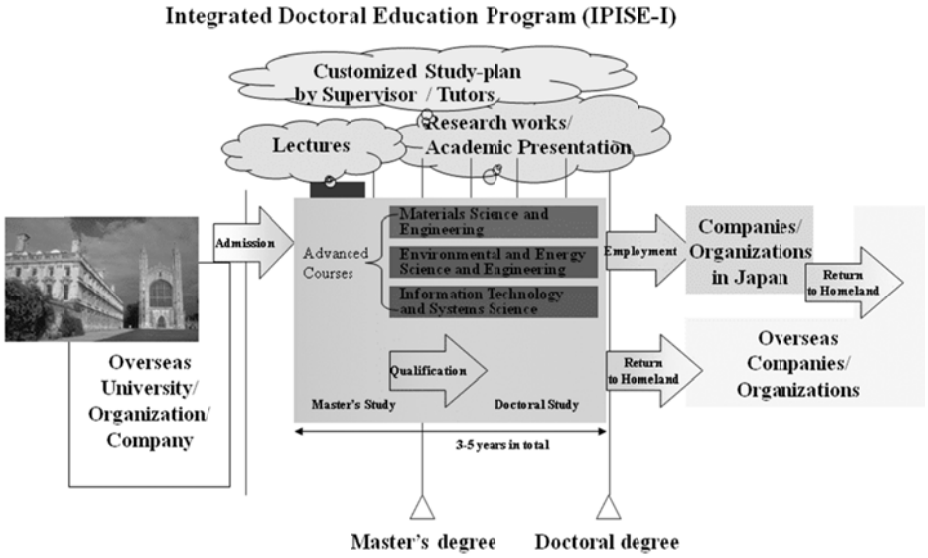
3. Graduate Study Guide

The IPISE offers three types of study programs, namely, Integrated Doctoral Education Program(I), Master's Program(M) and Doctoral Program(D).

The IPISE offers Integrated Doctoral Education Program(I), which is designed as a combined program continuing from Master's Program to Doctoral Program. However, the 11 member departments of the IPISE, which belong to Interdisciplinary Graduate School of Science and Engineering (IGS), offer Master's Programs(M) and Doctoral Programs(D) under the similar curricula as IPISE. Detailed explanation of each program together with requirement for degree conferred is as follows.

(I) Integrated Doctoral Education Program (IPISE IGP(A))

The Integrated Doctoral Education Program is designed as a combined program continuing from Master's Program to Doctoral Program, so that enrolled students can obtain both of the degrees in three to five years. Therefore, even candidates with master's degree are required to enroll from the beginning of master's program.



In the master's program, the student who satisfies the following requirement is conferred a master's degree, and is qualified to continue the Doctoral study with some formalities.

(1) Credits

30 or more credits must be acquired. In these credits:

a. 18 credits or more must be acquired from the subjects of "Research Courses" and "Courses by Departments" offered by the department you enroll in. The "Research Courses" and "Courses by Departments" are composed of the research subjects such as seminar subjects and advanced subjects related with your Department field.

b. 2 credits or more must be acquired from the subjects from "Liberal Arts and General Education(G)" offered by all Departments, such as Modern Japan and international communication subjects.

c. 10 credits acquired at other university can be transferred after submission of the designated form, and approval by supervisor, lecturer and department head.

d. The seminar and other compulsory subjects at each term must be acquired (*).
e. Other compulsory subjects must be taken.
Note that the required number of credits about the compulsory subject might be different depending on the departments (Refer the list of subject of each department).
f. 4 credits of lectures provided in Japanese, except credits transferred from other universities (mentioned at c.), are allowed at maximum to be included in the above designated number of credits. Note that it does not mean to prevent students to obtain more credits of the lectures provided in Japanese.

*: A student who is approved to shorten the period of study can skip the subjects in the shortened period.

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

In the Doctoral program, the candidate who satisfies the following requirements, is conferred a Doctoral degree.

(1) Seminar and other compulsory subjects in each term must be taken (*).
(2) The candidate must complete and upload a thesis for the degree, and pass the final examination to evaluate his/her thesis.

Note that the above requirements are minimal and some additional requirements may be conditioned depending on the department. All students are strongly advised to consult with their own supervisors about the study plan.

(M) Master's Program (pre-Doctoral) (IGS IGP(C))

An enrolled student who obtains the designated number of credits within a pre-determined program of study in his/her department after at least two years of supervised study will be awarded a Master's degree after approval of his/her thesis and a successful final examination. A student who made an outstanding academic record during the program may be able to shorten the period of study to a minimum of one year.

The student who satisfies the following requirement is conferred a master's degree.

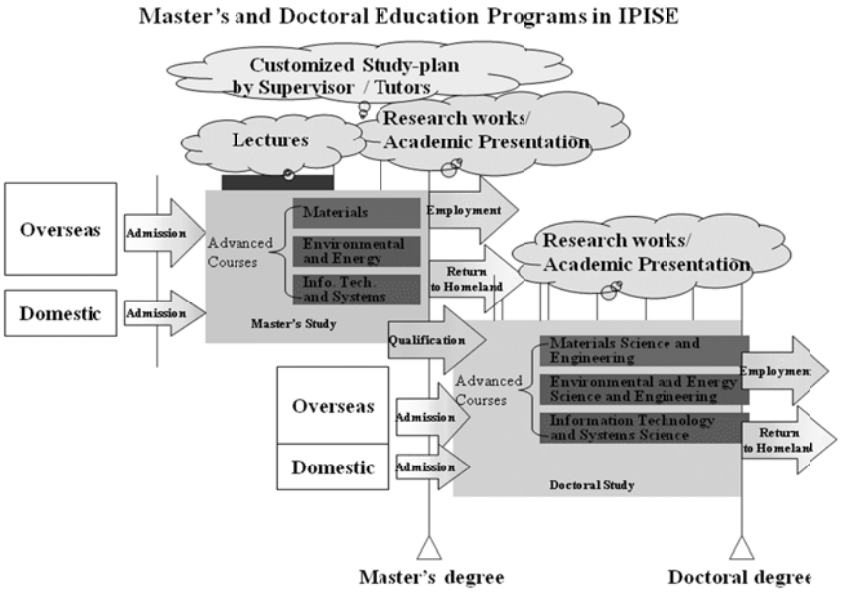
(1) Credits
30 or more credits must be acquired. In these credits:
a. 18 credits or more must be acquired from the subjects of "Research Courses" and "Courses by Departments" offered by the department you enroll in. The "Research Courses" and "Courses by Departments" are composed of the research subjects such as seminar subjects and advanced subjects related with your Department field.
b. 2 credits or more must be acquired from the subjects from "Liberal Arts and General Education(G)" offered by all Departments, such as Modern Japan and international communication subjects.
c. 10 credits acquired at other university can be transferred after submission of the designated form, and approval by supervisor, lecturer and department head.
d. The seminar and other compulsory subjects at each term must be acquired (*).
e. Other compulsory subjects must be taken.
Note that the required number of credits about the compulsory subject might be different depending on the departments (Refer the list of subject of each department).
f. 4 credits of lectures provided in Japanese, except credits transferred from other universities (mentioned at c.), are allowed at maximum to be included in the above designated number of credits. Note that it does not mean to prevent students to obtain more credits of the lectures provided in Japanese.

*: A student who is approved to shorten the period of study can skip the subjects in the shortened period.

(2) Thesis

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

The students qualified by the examination committee are admitted to go onto the Doctoral program with some formalities.



(D) Doctoral Program (IGS IGP(C))

An enrolled student who obtains the designated number of credits within a pre-determined program of study in his/her department after at least three years of supervised study will be awarded a Doctoral degree after approval of his/her thesis and a successful final examination. A student who made an outstanding academic record and research achievement during the program may be able to shorten the period of study to a minimum of one year. The minimum period that includes both the master's and doctoral program can be three years in total.

The candidate who satisfies the following requirements is conferred a Doctoral degree.

(1) Seminar and other compulsory subjects in each term must be taken (*).

(2) The candidate must complete and upload a thesis for the degree, and pass the final examination to evaluate his/her thesis.

*: A student who is approved to shorten the period of study can skip the subjects in the shortened period.

Note that the above requirements are minimal and some additional requirements may be conditioned depending on the department. All students are strongly advised to consult with their own supervisors about the study plan.

4-1 Department of Innovative and Engineered Materials (IEM)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
97725	IPISE Seminar (IEM-M) I	1-0-0	Supervisor	Autumn	○	○
97726	IPISE Seminar (IEM-M) II	1-0-0	Supervisor	Spring	○	○
97727	IPISE Seminar (IEM-M) III	1-0-0	Supervisor	Autumn	○	○
97728	IPISE Seminar (IEM-M) IV	1-0-0	Supervisor	Spring	○	○
97851	IPISE Seminar (IEM) V	2-0-0	Supervisor	Autumn	○	○ Dr.
97852	IPISE Seminar (IEM) VI	2-0-0	Supervisor	Spring	○	○ Dr.
97853	IPISE Seminar (IEM) VII	2-0-0	Supervisor	Autumn	○	○ Dr.
97854	IPISE Seminar (IEM) VIII	2-0-0	Supervisor	Spring	○	○ Dr.
97855	IPISE Seminar (IEM) IX	2-0-0	Supervisor	Autumn	○	○ Dr.
97856	IPISE Seminar (IEM) X	2-0-0	Supervisor	Spring	○	○ Dr.

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
97005	Advanced Photo-Electronic Devices	2-0-0	Y. Kitamoto, H. Funakubo, H. Wada	Autumn		
97015	Topics in Innovative Materials Science I	2-0-0	O. Odawara K. Nagai M. Azuma	Spring		
97016	Topics in Innovative Materials Science II	2-0-0	K. Nakamura, T. Iyoda T. Tada M. Kitano	Autumn		
97036	Phase Diagram and Related Thermodynamics	2-0-0	H. Hosoda T. Inamura	Autumn (Even Years)		
97052	Materials Science 101	2-0-0	T. Sasagawa T. Kamiya M. Azuma	Autumn		
96048	Characteristics & Applications of Intermetallic Alloys*	2-0-0	Y. Kimura	Spring (Even years)		
96049	Lattice Defects & Mechanical Properties of Materials*	2-0-0	S. Onaka, M. Kato	Autumn (Even years)		
96050	Diffusion in Alloys*	2-0-0	M. Kajihara	Autumn (Even years)		

96055	Advanced Course in Design and Fabrication of Micro/Nano Materials*	2-0-0	Masato Sone T.-F. M. Chang	Autumn (Odd years)		
96058	Introduction to Solid State Science	2-0-0	Y. MAJIMA, H. HIRAYAMA, H. HOSONO, T. TANIYAMA, M. ITOH, T. SUSAKI	Autumn (Odd years)		
96059	Optics of Semiconductors and Luminescent Materials	2-0-0	Satoshi MATSUISHI	Autumn		
96060	Advanced Ferrous and Non-ferrous Materials*	2-0-0	Y. Terada	Spring (Even years)		
24058	Crystallography for Microstructural Characterization**	2-0-0	T. Fujii	Autumn		
97555	IPISE Internship (IEM) IA	0-0-1	Department Chair	Spring		
97556	IPISE Internship (IEM) IB	0-0-1	Department Chair	Autumn		
97557	IPISE Internship (IEM) IIA	0-0-2	Department Chair	Spring		
97558	IPISE Internship (IEM) IIB	0-0-2	Department Chair	Autumn		
89135	Seminar for Cultivating International Understandings I***	0-2-0	K. Kajikawa	Autumn	○	○
89136	Seminar for Cultivating International Understandings II***	0-1-0	K. Kajikawa	Spring	○	○
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn	○	○
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
97715	IPISE Academic Presentation (IEM) I	0-1-0	Supervisor	Autumn	○	
97716	IPISE Academic Presentation (IEM) II	0-1-0	Supervisor	Spring	○	
97717	IPISE Academic Presentation (IEM) III	0-1-0	Supervisor	Autumn	○	
97718	IPISE Academic Presentation (IEM) IV	0-1-0	Supervisor	Spring	○	
97861	IPISE Academic Presentation (IEM) V	0-1-0	Supervisor	Autumn	○	
97862	IPISE Academic Presentation (IEM) VI	0-1-0	Supervisor	Spring	○	
97863	IPISE Academic Presentation (IEM) VII	0-1-0	Supervisor	Autumn	○	
97864	IPISE Academic Presentation (IEM) VIII	0-1-0	Supervisor	Spring	○	
97865	IPISE Academic Presentation (IEM) IX	0-1-0	Supervisor	Autumn	○	
97866	IPISE Academic Presentation (IEM) X	0-1-0	Supervisor	Spring	○	
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese.					

1) ○: Compulsory. None: Optional.

2) *: Mainly organized by Department of Materials Science and Engineering

3) **: Mainly organized by Department of Metallurgy and Ceramics Science

4) ***: Mainly organized by Department of Electronics and Applied Physics

【97016】Topics in Innovative Materials Science II, 2 credits, Autumn Semester

K. Nakamura, T. Iyoda

Each instructor gives lectures relevant to recent topics and progress in the field of materials with novel functions. Some of the lectures are organized as seminars, in which each student gives a short presentation on a topic selected by her/himself and agreed by her/his instructor(s).

【97052】Materials Science 101, 2 credits, Autumn Semester

T. Sasagawa, T. Kamiya, M. Azuma

This is an introductory course on materials science (solid state physics), with emphasis on electronic properties of crystalline materials. After studying the basics of quantum mechanics and the band theory, lectures are extended to advanced topics such as superconductors, semiconductor applications, and crystallographic symmetry.

【97015】Topics in Innovative Materials Science I, 2 credits, Spring Semester

O. Odawara, K. Nagai, M. Azuma

The purpose of the lecture is to present innovative concepts and technologies for the exploration, characterization and utilization of materials and devices. *Status quo* of nanotechnologies in materials, processing and applications is overviewed.

【97036】Phase Diagram and Related Thermodynamics, 2 credits, Autumn Semester, Even Years

H. Hosoda, T. Inamura

The purpose of this lecture is a comprehensive understanding of the alloy phase diagrams in the binary and ternary systems through studying the phase reaction, the phase rule, Gibbs free energy and related features. Besides, microstructures are discussed in connection with alloy phase diagrams. Besides, practice is provided in each class to develop understanding.

【97005】Advanced Photo-Electronic Devices, 2 credits, Autumn Semester

Y. Kitamoto, H. Funakubo, H. Wada

This lecture will provide essential knowledge for students who are engaged in research projects related to materials and device developments, giving the representative examples of advanced electronics, magnetic and ferroelectric devices and learning through case studies: how spin and charge degrees of freedom in carriers affect on materials properties and functions, how important device processes are for their better performance, and so on.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
97551	IPISE International Communication (IEM) I	0-1-0	Supervisor	Autumn	#1	#2
97552	IPISE International Communication (IEM) II	0-1-0	Supervisor	Spring	#1	#2
97553	IPISE International Communication (IEM) III	0-1-0	Supervisor	Autumn	#1	#2
97554	IPISE International Communication (IEM) IV	0-1-0	Supervisor	Spring	#1	#2
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.
2) #1: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.
3) #2: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken in master's course.
4) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).
5) ※ 2014 No Lecture

4-2 Department of Electronic Chemistry (ECHEM)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
95705	IPISE Seminar (ECHEM) I	0-2-0	Supervisor	Autumn, M1	○	○Mr.
95706	IPISE Seminar (ECHEM) II	0-2-0	Supervisor	Spring, M1	○	○Mr.
95707	IPISE Seminar (ECHEM) III	0-2-0	Supervisor	Autumn, M2	○	○Mr.
95708	IPISE Seminar (ECHEM) IV	0-2-0	Supervisor	Spring, M2	○	○Mr.
95851	IPISE Seminar (ECHEM) V	0-2-0	Supervisor	Autumn, D1	○	○Dr.
95852	IPISE Seminar (ECHEM) VI	0-2-0	Supervisor	Spring, D1	○	○Dr.
95853	IPISE Seminar (ECHEM) VII	0-2-0	Supervisor	Autumn, D2	○	○Dr.
95854	IPISE Seminar (ECHEM) VIII	0-2-0	Supervisor	Spring, D2	○	○Dr.
95855	IPISE Seminar (ECHEM) IX	0-2-0	Supervisor	Autumn, D3	○	○Dr.
95856	IPISE Seminar (ECHEM) X	0-2-0	Supervisor	Spring, D3	○	○Dr.
95725	Special Experiments (ECHEM) I	0-0-1	Supervisor	Autumn, M1	○	○Mr.
95726	Special Experiments (ECHEM) II	0-0-1	Supervisor	Spring, M1	○	○Mr.
95727	Special Experiments (ECHEM) III	0-0-1	Supervisor	Autumn, M2	○	○Mr.
95728	Special Experiments (ECHEM) IV	0-0-1	Supervisor	Spring, M2	○	○Mr.

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
95039	Nanotechnology and Nanoscience	2-0-0	Masahiko HARA Tomohiro HAYASHI	Spring (Even Year)		
95045	Advanced Catalytic Chemistry	2-0-0	Junko NOMURA	Autumn (Odd Year)		
95037	Fundamental Electrochemistry	2-0-0	Takeo OHSAKA, Fusao KITAMURA	Autumn (Odd Year)		
95046	Fundamental Biological Chemistry	2-0-0	Kan TANAKA Sousuke IMAMURA	Autumn (Odd Year)		
95051	Laser Spectroscopy for Chemistry	2-0-0	Masaaki FUJII, Makoto SAKAI	Autumn (Odd Year)		
95041	Fundamental Science of Thermodynamics and Magnetics	2-0-0	Hitoshi KAWAJI Nobuhiro MATSUSHITA	Autumn (Even Year)		
95047	Organic Synthesis	2-0-0	Kimihiro MATSUKAWA Munenori INOUE	Autumn (Even Year)		

95048	Inorganic Materials Science	2-0-0	Ryoji KANNO Masaaki HIRAYAMA	Autumn (Even Year)		
95038	Organic Molecular and Macromolecular Chemistry	2-0-0	Yoshiro YAMASHITA, Ikuyoshi TOMITA	Autumn (Odd Year)		
95058	Semiconductor Physics and Devices	2-0-0	Hiroshi YAMAMOTO, Kazunari OZASA	Autumn (Even Year)		
95049	Organic Electrode Process	2-0-0	Shinsuke INAGI	Autumn (Even Year)		
95021	Coordination Chemistry	2-0-0	Takanori FUKUSHIMA, Take-aki KOIZUMI	Autumn (Odd Year)		
95059	Applied Electrochemistry	2-0-0	Yukari SATO, Jiro NAKAMURA	Autumn (Odd Year)		
95074	Topics in Process Chemistry	2-0-0	Hiroyuki NAKAMURA	Autumn (Odd Year)		
95715	IPISE Academic Presentation (ECHEM) I	0-1-0	Supervisor	Autumn, M1	○	
95716	IPISE Academic Presentation (ECHEM) II	0-1-0	Supervisor	Spring, M1	○	
95717	IPISE Academic Presentation (ECHEM) III	0-1-0	Supervisor	Autumn, M2	○	
95718	IPISE Academic Presentation (ECHEM) IV	0-1-0	Supervisor	Spring, M2	○	
95861	IPISE Academic Presentation (ECHEM) V	0-1-0	Supervisor	Autumn, D1	○	
95862	IPISE Academic Presentation (ECHEM) VI	0-1-0	Supervisor	Spring, D1	○	
95863	IPISE Academic Presentation (ECHEM) VII	0-1-0	Supervisor	Autumn, D2	○	
95864	IPISE Academic Presentation (ECHEM) VIII	0-1-0	Supervisor	Spring, D2	○	
95865	IPISE Academic Presentation (ECHEM) IX	0-1-0	Supervisor	Autumn, D3	○	
95866	IPISE Academic Presentation (ECHEM) X	0-1-0	Supervisor	Spring, D3	○	
95555	IPISE Internship (ECHEM) IA	0-0-1	Department Chair	Spring		
95556	IPISE Internship (ECHEM) IB	0-0-1	Department Chair	Autumn		
95557	IPISE Internship (ECHEM) IIA	0-0-2	Department Chair	Spring		
95558	IPISE Internship (ECHEM) IIB	0-0-2	Department Chair	Autumn		

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

【95039】Nanotechnology and Nanoscience, 2 credits, Spring Semester, Even Years

M. Hara, T. Hayashi

Nanotechnology, the leading edge of modern science and technology, was born in the early 80's with the invention of the scanning probe microscopy by Drs. Binnig and Rohrer, Nobel laureates of IBM Zurich. It opened up a completely new window into the nanoscale world, and remains a challenging field in a wide variety of endeavors from solid state physics to molecular biology. In this lecture, we have attempted to accumulate and summarize the nanotechnology and nanoscience activities now underway in the world, and you will find that each story presents an innovative state-of-the-art subject in modern nanotechnological research.

1. Introduction of Nanotechnology and Nanoscience
2. Scanning Probe Microscopy and Spectroscopy
   - 2-1. History of Scanning Probe Microscopy (SPM): from Observation to Manipulation
   - 2-2. Scanning Tunneling Microscopy (STM) 1: Surface Chemistry and Phase Transitions
   - 2-3. Scanning Tunneling Microscopy (STM) 2: Self-Assembled Monolayers (SAM)
   - 2-4. Atomic Force Microscopy (AFM) 1: Biological Macromolecules and Surface Forces
   - 2-5. Atomic Force Microscopy (AFM) 2: Single Molecular Detection (SMD)
   - 2-6. Scanning Near-Field Optical Microscopy (SNOM) and Other Probe Methods: Fluorescence Decay Process, Proximity Effect and Further Possibilities
3. Introduction of surface & interface science
4. Experimental and theoretical techniques for surface & interface analysis
5. Chemical modification of solid surfaces (fundamentals and applications)
6. Biointerfaces (construction, analysis and applications)
7. Interactions at biointerfaces (theory and analysis)

【95045】Advanced Catalytic Chemistry, 2 credits, Autumn Semester, Odd Years

J. Nomura

"Green" approach to chemical processes are not only beneficial to the environment but also can boost profits, stimulated by the use of efficient catalysts. In this lecture, the basic concepts of catalysis, novel materials for catalytic applications, surface analytical techniques and frontier in catalytic chemistry will be presented.

1. Fundamental heterogeneous catalytic chemistry
2. New catalytic Materials
   a. Zeolites
   b. Mesoporous materials
   c. Photocatalysts
3. Surface analytical techniques-How can we clear up black boxes?
4. Green Chemistry by catalysts
   a. Solid acid and base catalysts
   b. Selective oxidation by catalysts

【95037】Fundamental Electrochemistry, 2 credits, Autumn Semester, Odd Years

T. Ohsaka, F. Kitamura

This course aims to develop the foundations and applications of electrode potentials from first principles

using a minimum of mathematics only assuming a basic knowledge of elementary thermodynamics.

1. Introduction
2. The origin of electrode potentials
3. Electron transfer at the electrode/solution interface
4. Thermodynamic description of electrochemical equilibrium
5. Nernst Equation
6. Activity and concentration
7. Activity coefficient
8. Measurement of Electrode Potentials
9. Standard Electrode Potentials
10. The relation of electrode potentials to the thermodynamics of the cell reaction
11. Standard electrode potentials and the direction of chemical reaction
12. Migration and diffusion
13. Applications of electrode potentials (1)
14. Applications of electrode potentials (2)

【95046】Fundamental Biological Chemistry, 2credit, Autumn Semester, Odd Years
K. Tanaka, S. Imamura

Living cells are composed of bio-molecules, such as sugar, lipid, protein and nucleic acid. This course will give fundamental knowledge on these components, as well as the basis of intracellular energy conversion and genetic information processing.

1. Introduction
2. Sugars and lipids
3. Amino acids, peptides and proteins
4. Nucleic acids
5. Catabolic metabolism and energy conversion
6. Mitochondria and chloroplasts
7. Genes and central dogma: Genetic information processing

【95051】Laser Spectroscopy for Chemistry, 2 credits, Autumn Semester, Odd Years
M. Fujii, M. Sakai

Laser spectroscopy is important tool to investigate the structure and dynamics of molecules and clusters in various circumstance such as in gas, a supersonic jet, solution, matrix and surface. This lecture gives the basic understanding of spectroscopy and instrumentations including lasers. The knowledge of quantum chemistry is required.

1. Introduction to Spectroscopy
2. Molecular Vibration
3. Nonlinear Spectroscopy #1
4. Nonlinear Spectroscopy #2
5. Time-resolved Spectroscopy #1
6. Time-resolved Spectroscopy #2

7. Time-domain vs Frequency domain
8. Born-Oppenheimer Approximation and Vibronic Coupling
9. Supersonic Jet Spectroscopy
10. Double Resonance Spectroscopy #1
11. Double Resonance Spectroscopy #2
12. Double Resonance Spectroscopy #3
13. Energy Relaxation
14. Relaxation and Reaction

【95041】Fundamental Science of Thermodynamics and Magnetics, 2 credits, Autumn Semester, Even Years
H. Kawaji, N. Matsushita

This lecture deals with the thermodynamics and magnetics of materials. In the first half, the temperature variation of the properties of materials will be discussed from the thermodynamic point of view. In the latter, the class deals the electronic state in crystal fields and the spin interaction to understand the magnetism of various materials.

1. Introduction to thermodynamics
2. Lows of thermodynamics
3. Entropy and statistical mechanics
4. Thermal excitations in materials
5. Heat capacity of materials
6. Thermodynamics of phase transitions
7. Microscopic models of phase transitions
8. Introduction to magnetics
9. Schroedinger equation
10. Angular momentum and quantum number
11. Crystal field and electron
12. Molecular orbital and exchange interaction
13. Molecular field theory I: para - and ferromagnetism
14. Molecular field theory II: antiferro- and ferrimagnetism

【95047】Organic Synthesis, 2 credits, Autumn Semester, Even Years
K. Matsukawa, M. Inoue

This lecture will be focused on the basic and advanced organic synthesis. The former will mainly cover the C-C bond formation reactions and the functional group transformations. The latter will deal with organic polymers by some polymerization methods. Furthermore, this lecture will present the synthesis of organic-inorganic hybrids and their properties.

1. Introduction
2. C-C Bond formation by using carbanion (1)
3. C-C Bond formation by using carbanion (2)
4. C-C Bond formation by using carbanion (3)
5. C-C Bond formation by using carbocation
6. C-C Bond formation by using radical and carbene

7. Functional group transformations
8. Introduction of macromolecules
9. Polymerizations and characterization of organic polymers
10. Network formation by photo-polymerization
11. Synthesis of organic-inorganic hybrid materials
12. Organic-inorganic hybrids with nano materials
13. Properties of organic-inorganic hybrid materials
14. Potential applications of organic-inorganic hybrid materials

【95048】Inorganic Materials Science, 2 credits, Autumn Semester, Even Years
R. Kanno, M. Hirayama

Inorganic materials science is concerned with the synthesis, structure, properties and applications of inorganic solid materials. The study of structure-property relations is very fruitful area and one with immense possibilities for the development of new materials or materials with unusual combination of properties.

1. What is materials chemistry
2. Crystal symmetry and crystal chemistry
3. Chemical bonding in solids
4. Nonstoichiometry in solids
5. Interpretation of phase diagram
6. Structure and property relationship in electronic conducting materials
7. Structure and property relationship in magnetic materials
8. Structure and property relationship in electrochemical materials

【95038】Organic Molecular and Macromolecular Chemistry, 2 credits, Autumn Semester, Odd Years
Y. Yamashita, I. Tomita

The aim of this course is to give an overview of molecular design of functional organic molecules and macromolecules. This lecture will cover the following topics.

1. Novel organic redox systems
2. Electroconductive and superconductive organic molecules
3. Organic field effect transistors (FET)
4. Organic ferromagnets
5. Inclusion complexes
6. Solid phase organic synthesis
7. Photo- and electro-luminescent organic materials
8. Fundamental aspects of step-growth polymerizations
9. Recent topics on step-growth polymerizations
10. Fundamental aspects of chain polymerizations
11. Living polymerization and macromolecular design through living processes
12. Recent topics on chain polymerizations
13. Reactive polymers
14. Functional polymers

【95058】Semiconductor Physics and Devices, 2 credits, Autumn Semester, Even Years

H.Yamamoto, K. Ozasa

This lecture covers the basic physics of semiconductors and various applications including transistors, sensors, LEDs, and solar cells.
First half focuses on inorganic semiconductors and second half on organic semiconductors.

1. Quantum levels, Schroedinger equation, Atom to crystal, Energy band
2. Density of states, Fermi energy, Carrier, Effective mass
3. Electric conduction, Excitation and relaxation, Diffusion, Lifetime
4. PN junction, Diffusion potential, Depletion layer, I-V characteristics
5. Solar cells, LED, Lasers
6. MOS-FET, Flash memory, CCD
7. Nanostructures, Nanocrystals, CNT, Nanowires
8. Molecular orbital and Huckel approximation
9. Band calculation based on tight-binding approximation
10. Molecular conductors and graphene
11. Electric transport under magnetic field
12. Organic Field-Effect-Transistors
13. Highly-correlated materials and electronic device
14. Light-emitting molecules and organic photovoltaics

【95049】Organic Electrode Process, 2 credits, Autumn Semester, Even Years

S. Inagi

This lecture will cover the fundamentals and applications of organic electrochemistry. Some of the topics dealt with are as follows:

1. Introduction to electroorganic synthesis
2. Direct and indirect electron transfer
3. Reaction selectivity
4. Electrogenerated acid and base
5. Paired electrosynthesis
6. Electropolymerization
7. Recent progress in organic electrochemistry

【95021】Coordination Chemistry, 2 credits, Autumn Semester, Odd Years

T. Fukushima, T. Koizumi

This course intends to give an overview of coordination chemistry to the graduate students. Recent developments and trends of transition metal-containing compounds and nanomaterials are also discussed. This course covers the following topics.

1. Introduction of coordination chemistry
2. Stereochemistry of metal complexes
3. Synthesis of metal complexes
4. Reactivity of metal complexes

5. Electrochemistry of transition metal complexes
6. Recent topics in coordination chemistry
7. Synthesis and Properties of Coordination Polymers
8. Nanomaterials formed by coordination bonds

【95059】Applied Electrochemistry, 2 credits, Autumn Semester, Odd Years

Y. Sato, J. Nakamura

Electrochemical sensing devices such as chemical and biochemical sensors, and energy devices such as batteries and fuel cells, will be introduced and discussed with the emphasis on surface and material properties. Based on the fundamental understanding of electrochemical reaction and materials, history of these devices and the technological trend will be also overviewed.

1. Introduction to battery technology
2. Introduction to Chemical and Biochemical Sensors
3. Reactions and performance of batteries
4. Lithium batteries and their safety
5. Lithium ion batteries
6. Electrode design for lithium ion batteries
7. Fuel cells
8. Metal air batteireis
9. Biomaterials for chemical and biosensors
10. Electrochemical sensors
11. Affinity sensors (DNA, Proteins etc.)
12. Micro and nano-sensors
13. Electrochemical microfluidic devices for bioanalysis
14. Ubiquitous Sensor Systems

【95074】Topics in Process Chemistry, 2 credits, Autumn Semester, Odd Years

H. Nakamura

This lecture is aimed at students who have a basic grounding in organic chemistry and attempts to convey an understanding organic process research with special focus on the development and optimization of chemical reactions and processes and their transfer to a larger scale, via large laboratory and pilot plant operations, for manufacture. This lecture covers research and development in the fine organic chemicals including pharmaceuticals. Students are encouraged to discuss synthetic route strategy and design, giving reasons and rationale for choice of reagents, solvents, conditions, etc., and learn unexpected differences observed as processes are scaled up. Students also learn aspects which may be important including yield improvement, cost reduction, improvement in space-time yield, etc. with reaction conditions, choice of solvent, workup and product isolation, safety, and environmental considerations.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
89135	Seminar for Cultivating International Understandings Ⅰ	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings Ⅱ	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
95551	IPISE International Communication (ECHEM) I	0-1-0	Supervisor	Autumn	#1	#2
95552	IPISE International Communication (ECHEM) II	0-1-0	Supervisor	Spring	#1	#2
95553	IPISE International Communication (ECHEM) III	0-1-0	Supervisor	Autumn	#1	#2
95554	IPISE International Communication (ECHEM) IV	0-1-0	Supervisor	Spring	#1	#2
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.
2) #1: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.
3) #2: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken in master's course.
4) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).
5) ※ 2014 No Lecture

4-3 Department of Materials Science and Engineering (MSE)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96705	IPISE Seminar (MSE) I	2-0-0	Supervisor	Autumn	○	○
96706	IPISE Seminar (MSE) II	2-0-0	Supervisor	Spring	○	○
96707	IPISE Seminar (MSE) III	2-0-0	Supervisor	Autumn	○	○
96708	IPISE Seminar (MSE) IV	2-0-0	Supervisor	Spring	○	○
96851	IPISE Seminar (MSE) V	2-0-0	Supervisor	Autumn	○	○Dr.
96852	IPISE Seminar (MSE) VI	2-0-0	Supervisor	Spring	○	○Dr.
96853	IPISE Seminar (MSE) VII	2-0-0	Supervisor	Autumn	○	○Dr.
96854	IPISE Seminar (MSE) VIII	2-0-0	Supervisor	Spring	○	○Dr.
96855	IPISE Seminar (MSE) IX	2-0-0	Supervisor	Autumn	○	○Dr.
96856	IPISE Seminar (MSE) X	2-0-0	Supervisor	Spring	○	○Dr.

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96048	Characteristics & Applications of Intermetallic Alloys	2-0-0	Y. Kimura	Spring (Even years)		
96049	Lattice Defects & Mechanical Properties of Materials	2-0-0	S. Onaka, M. Kato	Autumn (Even years)		
96050	Diffusion in Alloys	2-0-0	M. Kajihara	Autumn (Even years)		
96055	Advanced Course in Design and Fabrication of Micro/Nano Materials	2-0-0	M. Sone T.-F. M. Chang	Autumn (Odd years)		
96058	Introduction to Solid State Science	2-0-0	Y. Majima, H. Hirayama, H. Hosono, T. Taniyama, M. Itoh, T. Susaki,	Autumn (Odd years)		
96059	Optics of Semiconductors and Luminescent Materials	2-0-0	S. Matsuishi	Autumn		
96060	Advanced Ferrous and Non-ferrous Materials	2-0-0	Y. Terada	Spring (Even Years)		

97005	Advanced Photo-Electronic Devices*	2-0-0	Y. Kitamoto, H. Funakubo, H. Wada	Autumn		
97015	Topics in Innovative Materials Science I*	2-0-0	O. Odawara K. Nagai M. Azuma	Spring		
97016	Topics in Innovative Materials Science II*	2-0-0	K. Nakamura, T. Iyoda, T. Tada, M. Kitano	Autumn		
97036	Phase Diagram and Related Termodynamics*	2-0-0	H. Hosoda T. Inamura	Autumn (Even Years)		
97052	Materials Science 101*	2-0-0	T. Sasagawa T. Kamiya M. Azuma	Autumn		
89135	Seminar for Cultivating International Understandings I**	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II**	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property****	1-0-0	Y. Hayashi	Autumn		
96555	IPISE Internship (MSE) IA	0-0-1	Department Chair	Spring		
96556	IPISE Internship (MSE) IB	0-0-1	Department Chair	Autumn		
96557	IPISE Internship (MSE) IIA	0-0-2	Department Chair	Spring		
96558	IPISE Internship (MSE) IIB	0-0-2	Department Chair	Autumn		
96715	IPISE Academic Presentation (MSE) I	0-1-0	Supervisor	Autumn	○	
96716	IPISE Academic Presentation (MSE) II	0-1-0	Supervisor	Spring	○	
96717	IPISE Academic Presentation (MSE) III	0-1-0	Supervisor	Autumn	○	
96718	IPISE Academic Presentation (MSE) IV	0-1-0	Supervisor	Spring	○	
96861	IPISE Academic Presentation (MSE) V	0-1-0	Supervisor	Autumn	○	
96862	IPISE Academic Presentation (MSE) VI	0-1-0	Supervisor	Spring	○	
96863	IPISE Academic Presentation (MSE) VII	0-1-0	Supervisor	Autumn	○	
96864	IPISE Academic Presentation (MSE) VIII	0-1-0	Supervisor	Spring	○	
96865	IPISE Academic Presentation (MSE) IX	0-1-0	Supervisor	Autumn	○	
96866	IPISE Academic Presentation (MSE) X	0-1-0	Supervisor	Spring	○	
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese.					

1) ○: Compulsory. None: Optional.
2) Dr: For Doctor's course student.
3) *: Mainly organized by Department of Innovative and Engineered Materials
4) **: Mainly organized by Department of Electronics and Applied Physics

5) ***: Mainly organized by Department of Energy Sciences

【96048】Characteristics & Applications of Intermetallic Alloys, 2 credits, Spring Semester, Even years
Y. Kimura

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

【96049】Lattice Defects & Mechanical Properties of Materials, 2 credits, Autumn Semester, Even years
S. Onaka, M. Kato

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

【96050】Diffusion in Alloys, 2 credits, Autumn Semester, Even years
M. Kajihara

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

【96055】Advanced Course in Design and Fabrication of Micro/Nano Materials, 2 credits, Autumn Semester , Odd years
M. Sone, T.-F. M. Chang

Recent methods of material design or precise fabrication in micro/nano scale; lithography, electroplating, CVD, ALD or etc. and applications will be explained.

【96058】Introduction to Solid State Science, 2 credits, Autumn Semester , Odd years
Y. Majima, H. Hirayama, H. Hosono, T. Taniyama, M. Itoh, T. Susaki

We review several important phenomena in solid state science. It is assumed that the students have been familiar with Chapters 1-7 of Charles Kittel's "Introduction to Solid State Physics, 8th Edition."
1. Semiconductors
2. Fermi Surfaces and Metals
3. Superconductivity
4. Paramagnetism, Ferromagnetism and Antiferromagnetism
5. Dielectrics and Ferroelectrics
6. Surface and Interface Physics

【96059】Optics of Semiconductors and Luminescent Materials, 2 credits, Autumn Semester , Odd years
S. Matsuishi

The present lecture provides a fundamental knowledge of optical response of materials, including crystalline insulators and semiconductors, glasses and metals. Starting from classical and quantum models for the light interaction with solid matter, optical phenomena in semiconductors and luminescent materials related to practical applications will be explained.

【96060】Advanced Ferrous and Non-ferrous Materials, 2 credits, Spring Semester , Even years
Y. Terada

Ferrous and non-ferrous metallic materials are attracting interest as structural materials in the automotive industry, where they are instrumental in increasing fuel efficiency. In the present lecture, the microstructure evolution during heat treatments will be reviewed for the ferrous and non-ferrous metallic materials, together with their mechanical properties. Topics such as phase diagram, normal structure, CCT & TTT diagrams, tempering process, and age hardening behavior are included.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
96551	IPISE International Communication (MSE) I	0-1-0	Supervisor	Autumn	#1	#2
96552	IPISE International Communication (MSE) II	0-1-0	Supervisor	Spring	#1	#2
96553	IPISE International Communication (MSE) III	0-1-0	Supervisor	Autumn	#1	#2
96554	IPISE International Communication (MSE) IV	0-1-0	Supervisor	Spring	#1	#2
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		

99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		

1) ○: Compulsory. None: Optional.
2) #1: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.
3) #2: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken in master's course.
4) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).
5) ※ 2014 No Lecture

==== <Advanced Course of Environmental and Energy Science and Engineering> ====

4-4 Department of Environmental Science and Technology (DEPE)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
98705	IPISE Seminar (DEPE) I	2-0-0	Supervisor	Autumn, M1	○	○
98706	IPISE Seminar (DEPE) II	2-0-0	Supervisor	Spring, M1	○	○
98707	IPISE Seminar (DEPE) III	2-0-0	Supervisor	Autumn, M2	○	○
98708	IPISE Seminar (DEPE) IV	2-0-0	Supervisor	Spring, M2	○	○
98851	IPISE Seminar (DEPE) V	2-0-0	Supervisor	Autumn, D1	○	○
98852	IPISE Seminar (DEPE) VI	2-0-0	Supervisor	Spring, D1	○	○
98853	IPISE Seminar (DEPE) VII	2-0-0	Supervisor	Autumn, D2	○	○
98854	IPISE Seminar (DEPE) VIII	2-0-0	Supervisor	Spring, D2	○	○
98855	IPISE Seminar DEPE) IX	2-0-0	Supervisor	Autumn, D3	○	○
98856	IPISE Seminar (DEPE) X	2-0-0	Supervisor	Spring, D3	○	○
98725	IPISE Special Seminar for Environmental Studies (DEPE) I *	1-0-0	Department Chair	Autumn, M1		
98726	IPISE Special Seminar for Environmental Studies (DEPE) II *	1-0-0	Department Chair	Spring, M1		
98727	IPISE Special Seminar for Environmental Studies (DEPE) III *	3-0-0	Department Chair	Autumn, M2		
98744	IPISE Special Seminar for Environmental Studies (DEPE) IV *	1-0-0	Department Chair	Spring, M1		
98745	IPISE Special Seminar for Environmental Studies (DEPE) V *	1-0-0	Department Chair	Autumn, M1		
98746	IPISE Special Seminar for Environmental Studies (DEPE) VI *	3-0-0	Department Chair	Spring, M2		
98715	IPISE Academic Presentation (DEPE) I	0-1-0	Supervisor	Autumn, M1	○	○
98716	IPISE Academic Presentation (DEPE) II	0-1-0	Supervisor	Spring, M1	○	○
98717	IPISE Academic Presentation (DEPE) III	0-1-0	Supervisor	Autumn, M2	○	○
98718	IPISE Academic Presentation (DEPE) IV	0-1-0	Supervisor	Spring, M2	○	○
98861	IPISE Academic Presentation (DEPE) V	0-1-0	Supervisor	Autumn, D1	○	○
98862	IPISE Academic Presentation (DEPE) VI	0-1-0	Supervisor	Spring, D1	○	○
98863	IPISE Academic Presentation (DEPE) VII	0-1-0	Supervisor	Autumn, D2	○	○
98864	IPISE Academic Presentation (DEPE) VIII	0-1-0	Supervisor	Spring, D2	○	○
98865	IPISE Academic Presentation (DEPE) IX	0-1-0	Supervisor	Autumn, D3	○	○
98866	IPISE Academic Presentation (DEPE) X	0-1-0	Supervisor	Spring, D3	○	○

1) ○: Compulsory. None: Optional.

2) *: The asterisked subjects are provided exclusively for students who belong to Department of Environmental Science and Technology.

(+)Year: The Year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
98089	Applied Mathematics for Environmental Study 1A	1-0-0	T. Ishikawa	Spring		
98090	Applied Mathematics for Environmental Study 1B	1-0-0	T. Nakamura	Autumn		
98091	Applied Mathematics for Environmental Study 2A	1-0-0	H. Yamanaka	Spring		
98092	Applied Mathematics for Environmental Study 2B	1-0-0	T. Asawa	Autumn		
98093	Applied Environmental Science 1A	1-0-0	T. Tamura	Spring		
98095	Applied Environmental Science 1B	1-0-0	T. Kinouchi	Autumn		
98096	Applied Environmental Science 2A	1-0-0	K. Takeshita, Y. Kato	Spring		
98097	Applied Environmental Science 2B	1-0-0	K. Takeshita, Y. Kato	Autumn		
98081	International Communication on Environmental Problems I*	2-0-0	S. Nishikizawa, Y. Sato et al.	Spring		
98082	International Communication on Environmental Problems II*	2-0-0	K. Yoshikawa, F. Takahashi et al.	Spring		
98087	Environmental Impact Assessment I	1-0-0	S. Nishikizawa	Autumn		
98088	Environmental Impact Assessment II	1-0-0	T. Murayama,	Autumn		
98006	Environmental Turbulence	1-0-0	T. Tamura	Autumn		
98083	Evaluation in International Perspective	1-0-0	Y. Sato	Autumn		
98016	Structural and Fire Resistant Design of Building Structures	2-0-0	S. Kono, Y. Shinohara	Autumn		
98027	Earthquake Resistant Limit State Design for Building Structures	2-0-0	S. Yamada, undecided	Autumn		
98009	Science and Technology for Atmosphere Environmental Protection	1-0-0	K. Yoshikawa	Spring		
98069	Urban Environmental Engineering	1-0-0	T. Asawa	Autumn		
98061	Process Dynamics and Control	1-0-0	H. Seki	Spring		

98060	Watershed Hydrology	1-0-0	T. Kinouchi	Spring		
98053	Open Channel Hydraulics	1-0-0	T. Ishikawa	Spring		
98067	Environmental Hydraulics	1-0-0	T. Nakamura	Spring		
98068	Exploration Geophysics	1-0-0	H. Yamanaka	Spring		
98064	Environmental Modeling	2-0-0	K. Takeshita Y. Kato	Spring		
98070	Elastic and Plastic Behaviors of Structural Materials	2-0-0	S. Kono, Y. Shinohara	Spring		
98094	Pollutant Control Technology and Process Design	1-0-0	F. Takahashi	Spring		
98086	Introduction to Geochemistry	1-0-0	S. Toyoda	Autumn		
98098	Environmental Biotechnology	1-0-0	H. Ueda	Autumn		
98099	The economics and systems analysis of environment, resources and technology	1-0-0	K. Tokimatsu	Autumn		
89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn	○	
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		

1) ○: Compulsory. None: Optional.

2) *: The asterisked subjects are provided exclusively for students who belong to Department of Environmental Science and Technology.

【98089】Applied Mathematics for Environmental Study 1A, 1 credit, Spring Semester

T. Ishikawa

In the first two lectures, idea of “the best approximation” is introduced on the basis of high school mathematics. The idea is applied to a linear differential equation to deduce Galerkin Method in the third lecture. In other lectures, extensions of the method such as relaxation of boundary conditions, the Finite Element Method are introduced. Exercise is considered as an important part of the course to obtain practical meaning of approximation.

【98090】Applied Mathematics for Environmental Study 1B, 1 credit, Autumn Semester

T. Nakamura

The lecture focuses on basic aspects in numerical analysis for environmental studies. While some basic acknowledgements on numerical calculation are introduced, approximate solutions of several essential partial differential equations by Finite Difference Method are explained.

【98091】Applied Mathematics for Environmental Study 2A, 1 credit, Spring Semester

H. Yamanaka

The lecture focuses on mathematical aspects in environmental data processing. Basic theories on random variable, probability, error analysis, spatial and temporal data processing and least square method are

explained with examples of recent actual environmental data.

【98092】Applied Mathematics for Environmental Study 2B, 1 credit, Autumn Semester
T. Asawa

The lecture focuses on probability and statistics in environmental data processing. Basic theory on statistical analysis, multivariate analysis, and quantification method are explained with actual examples of processing of recent environmental data.

【98093】Applied Environmental Science 1A, 1 credit, Spring Semester
T. Tamura

Regarding the physical dynamics in natural environment of the atmosphere as well as in natural disaster and its mitigation problems, the scientific methods of formulation are explained in views of fundamental and complex phenomena. Also, this lecture gives understanding of the physical mechanism on heat and mass transport problems in feasibility stage and the schemes to solve them.
１． Fundamental scientific techniques for understanding physical dynamics in the nature
２． Technical evolution and its concept for solving the complex problems in natural environment

【98095】Applied Environmental Science 1B, 1 credit, Autumn Semester
T. Kinouchi

Regarding the physical dynamics in natural environment of water and atmospheric areas as well as in natural disaster and its mitigation problems, the scientific methods of formulation are explained in views of fundamental and complex phenomena. In particular, this lecture focuses on the contaminant transport and kinetics in the aquatic and geospheric environment to acquire knowledge for real environmental phenomena and their problem-solving.
1. Scientific understanding of contaminant transport in the environment
2. Conservation and transport theory of mass, energy and transport
3. Formulation and analysis of contaminant transport in the environment

【98096】Applied Environmental Science 2A, 1 credit, Spring Semester
K. Takeshita, Y. Kato

The understanding of material transport in the environment is indispensable to consider various environmental problems. Fundamental knowledge of chemistry and chemical engineering is required to analyze and evaluate the mass transport in the environment. In this lecture, the fundamentals of chemistry and chemical engineering for environmental analysis on undergraduate course level are explained.
1. Fundamentals of chemistry and chemical engineering
2. Fundamental theory of material transport including chemical and biochemical reactions

【98097】Applied Environmental Science 2B, 1 credit, Autumn Semester
K. Takeshita, Y. Kato

The understanding of material transport in the environment is indispensable to consider various environmental problems. Fundamental knowledge of chemistry and chemical engineering is required to

analyze and evaluate the mass transport in the environment. In this lecture, the application of chemistry and chemical engineering for environmental analysis on graduated course level are explained.
1. Application of chemical reaction engineering of reactor design
2.Applications of material transport theory to environmental analysis

【98081】International Communication on Environmental Problems I, 2 credits, Spring Semester
S. Nishikizawa, Y. Sato et al.

We have established the present economic and social system through the overcoming of severe environmental pollutions of air, water and so forth. Those experiences could be suggestive for developing countries as well as taking principal roles with a view to creating a sustainable society in Japan. In this course, students learn fundamental factors and social background by reviewing past environmental pollutions. In addition to lectures, group works and presentations by students in English will be conducted.

【98082】International Communication on Environmental Problems II, 2 credits, Spring Semester
K. Yoshikawa, F. Takahashi et al.

A drastic review of Japanese energy strategy has been started after the accident of the Fukushima nuclear power station associated with a big earthquake. In this course, scenarios for Japanese energy supply will be proposed by Japanese students which enable gradual decrease of the dependence on the nuclear power down to zero within 20-30 years. In the case of foreign students, scenarios for energy supply increase in their home countries matching with the economic growth will be proposed without relying on the nuclear power. In the course of preparation of energy supply scenarios, lectures by external professionals, visits to power stations and the group activities mixing Japanese and foreign students will be done.

【98087】Environmental Impact Assessment I, 1 credit, Autumn Semester
S. Nishikizawa

Environmental Impact Assessment (EIA) is an important tool for public and private developments toward creating a sustainable society. In this course, students learn EIA theories, challenges and methods with several case studies. As well as scientific aspects such as forecast and evaluation, democratic aspects relating to public participation will be explained. We will also explore “strategic environmental assessment” as new areas of EIA.

【98088】Environmental Impact Assessment II, 1 credit, Autumn Semester
T. Murayama

Environmental Impact Assessment (EIA) is an important tool for public and private development and planning decisions toward creating a sustainable society. In this course, students learn EIA theories, methods, regulations and its historical outline with several case studies. Scientific aspects such as prediction and evaluation methods as well as democratic aspects relating to public participation will be explained. We will discuss about environmental and social consideration for international cooperation in developing countries.

【98006】Environmental Turbulence, 1 credit, Autumn Semester
T. Tamura

Various phenomena of the turbulence in nature are discussed in view of atmospheric environment or storm disaster. For their detailed analysis, the theoretical interpretation and the modeling representation are studied. Especially, this lecture elucidates the physical mechanism of complex turbulence with external forcing such as buoyancy or rotation, for understandings of original aspects in an atmospheric boundary layer. Also, for the appropriate numerical simulation, the required mathematical description and physical meaning of turbulence transport are explained. Computer simulation techniques are provided to solve various problems in nature, such as urban heat island, air pollution and storm impact on human society.

1. Analytical approach of fluid dynamics to atmospheric environments and wind hazard mitigation
2. Governing equations and their statistical treatment
3. Physical mechanism of complex turbulence and essence of atmospheric boundary layer
4. Partial differential equations of propagation problems and their numerical simulation
5. Turbulence modeling
6. Filtering technique and large eddy simulations (LES)
7. Application of turbulence modeling for solving problems in nature

【98083】Evaluation in International Perspective, 1 credit, Autumn Semester
Y. Sato

By taking this course, students are expected to deepen their understanding of major evaluation theories, their historical background and their application in the field of international cooperation and science & technology from international perspective. They can also expect to acquire basic evaluation skills through performing evaluation of their chosen topics or meta-evaluation of the existing evaluation reports.

【98016】Structural and Fire Resistant Design of Building Structures, 2 credits, Autumn Semester
S. Kono, Y. Shinohara

This lecture aims at mastering the synthetic knowledge about a fire-protection and fire-resistance of a building. The fundamental knowledge about a building fire-protection, urban fire-resistance, and a fire-resisting-construction design of a building is explained. Furthermore, the mechanical properties of the main structural materials (concrete and steel which constitute a building-construction) at elevated temperatures is explained.

1. Fire safety in buildings
2. Actual circumstances of a fire disaster
3. Phenomenon of a fire disaster
4. Fire detection and extinguishing a fire
5. Evacuation safety under a fire condition
6. Controlling a fire spread
7. Mechanical properties of structural materials at elevated temperatures
8. Structure performance in a fire

【98027】Earthquake Resistant Limit State Design for Building Structures, 2 credits, Autumn Semester
S. Yamada, undecided

Earthquake Resistant Limit State Design is a design method based on a balance of input energy by the earthquake and energy absorption capacity of building structures. In this lecture, the basic theory of design

method based on a balance of the energy and the evaluation method of earthquake resistant performance of the building structures based on the deformation capacity of members are explained.

1. Basic theory of the design method based on a balance of the energy
2. Earthquake input evaluated as the energy input
3. Hysteresis behavior of the steel material
4. Ultimate behavior of steel members under cyclic load
5. Energy absorption capacity of steel members
6. Damage evaluation of the structure
7. Damage distribution in the multi-story structure
8. The relationship between deformation capacity of members and deformation capacity of the frame
9. Estimation method of the required earthquake resistance
10. Energy spectrum of earthquake
11. Outline of the base isolated building structure
12. Design of the base isolated building structure

【98009】Science and Technology for Atmosphere Environmental Protection, 1 credit, Spring Semester
K. Yoshikawa

For atmosphere environmental protection, appropriate combination of various technologies ranging from combustion control, exhaust gas treatment, high efficiency energy conversion and waste management is essential. This lecture first explains the fundamental science of transport phenomena (momentum, energy and mass transportation) which should be base knowledge to understand various atmospheric environmental processes. Then variety of emission control techniques are explained to understand state of the art technologies for atmosphere environmental protection. Finally, new waste management technologies are introduced and students will join discussions on the effective measures for waste management to reduce atmosphere emissions.

【98069】Urban Environmental Engineering, 1 credit, Autumn Semester
T. Asawa

Urban environments are influenced by various factors, including the urban structure, buildings and the inhabitants' activities in the area. The heat island effect is one of the environmental problems in an urbanized area. The effective measures against those environmental problems are required for sustainable urban development and management. This lecture explains the fundamentals of urban and built environment, including the heat island effect and thermal environment, and discusses what we should do for our living environments.

1. Fundamentals of urban and built environment
2. Cause of the heat island effect
3. Theory and measurement of heat balance on urban surfaces
4. Thermal environment in urban space
5. Comfort in built environment
6. Inhabitants' activities and anthropogenic heat emissions
7. Urban greening and its effect on the environment

【98061】Process Dynamics and Control, 1 credit, Spring Semester

H. Seki

To achieve safe and efficient operations of today's highly integrated chemical processing plants, an understanding of the dynamic behavior is important from both process design and process control perspective. With an emphasis on the dynamic nature of chemical processes, the lecture will cover chemical process modeling (material and energy balances, constitutive relationships, etc.), numerical techniques (numerical integration, algebraic equations), and linear and nonlinear systems analysis (Laplace transforms, bifurcation, etc.). State-of-the-art chemical process control techniques will be also introduced.

【98060】Watershed Hydrology, 1 credit, Spring Semester

T. Kinouchi

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

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

【98053】Open Channel Hydraulics, 1 credit, Spring Semester

T. Ishikawa

Open Channel Hydraulics is a branch of applied fluid mechanics to support river management improvement works for flood disaster prevention and water environment conservation. This lecture first explains the fundamentals of open channel flow analysis based on the governing equations of fluid dynamics, and describes the important characteristics of river flows. Finally, the application examples of open channel hydraulics to river planning and improvement works.

1. Governing equations of fluid dynamics
2. One dimensional equations of open channel hydraulics
3. One dimensional characteristics of river flows
4. Two dimensional equations of open channel hydraulics
5. Secondary flows and sedimentation in rivers
6. Applications

【98067】Environmental Hydraulics, 1 credit, Spring Semester

T. Nakamura

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

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

【98068】Exploration Geophysics, 1 credit, Spring Semester
H. Yamanaka

Exploration geophysics, one of techniques for understanding geoenvironments in shallow and deep soil layers, is explained in this lecture with wide view of applications to disaster prevention, natural resource development, and environmental protection.

【98064】Environmental Modeling, 2 credits, Spring Semester
K. Takeshita, Y. Kato

Establishment of mathematical models for water environment is lectured. The derivations of fundamental equations for momentum transfer, heat transfer and mass transfer and the modeling techniques based on the chemical process analysis are explained. These fundamentals are applied to the modeling of practical water environments such as river, lake, basin, ground water and ocean. Topics dealt in the lecture are as follows:

1. Introduction to environmental modeling
2. Momentum transfer (fluid dynamics)
3. Mass transfer (diffusion equation)
4. Heat transfer
5. Fundamentals of chemical process analysis
6. Water environments
7. Establishment of mathematical models
8. Validity of mathematical models

【98070】Elastic and Plastic Behaviors of Structural Materials, 2 credits, Spring Semester
S. Kono, Y. Shinohara

The elastic and plastic behaviors of the concrete and steel currently most extensively used as a structural material of a high-rise building are explained. In particular, the three-dimensional stress and strain, the three-dimensional constitutive laws (Hooke's law), the three-dimensional plasticity theory of steel, and the failure criteria of concrete under multiaxial stresses are discussed to acquire an appropriately evaluating knowledge of an analytical result by a three-dimensional FEM.

1. Introduction
2. Some basic properties of concrete and steel
3. Stress in three dimensions
4. Principal stresses and principal Axes
5. Strain in three dimensions
6. Stress-strain relationship in elasticity
7. Two dimensional problems in elasticity
8. Yield criteria and stress-strain relationship in plasticity
9. Failure criteria of concrete
10. Examples of finite element analysis

【98094】Pollutant Control Technology and Process Design, 1 credit, Spring Semester
F. Takahashi

You will learn basic mechanisms of pollution control technologies for environmental protection in this lecture. This helps you understand that any pollution control technologies generate secondary pollution sources like wastewater and solid wastes inevitably, which needs additional treatment and disposal management. The goal of this lecture is to offer you some lessons to understand the importance of system designs for effective and efficient environmental protection. In some practice, you will try to optimize the systemization of pollution control technologies for reasonable and effective environmental protection.

【98086】Introduction to Geochemistry, 1 credit, Autumn Semester
S. Toyoda

Geochemistry is a discipline that aims to elucidate origin, constituents, and phenomenon of the earth, solar system, and universe. In this lecture, basic theories and methods for understanding origin and composition of materials of the earth and their cycles are explained from the view point of chemistry.

【98098】Environmental Biotechnology, 1 credit, Autumn Semester
H. Ueda

Biotechnology is a key technology in 21st century in many areas including environmental sciences. Environmental biotechnology is defined as the development, use and regulation of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes (green manufacturing technologies and sustainable development). The first half of this lecture introduces biotechnology in general, and then focuses on its application in environmental areas.

【98099】The economics and systems analysis of environment, resources and technology, 1 credit, Autumn Semester
K. Tokimatsu

This course provides an introduction and related basic theory of economics and systems analysis of environment, resources and technology. The coverage of the topics is very broad as listed below, with which you could be faced after your graduation. The level of this course is around middle class, between upper class of undergraduates and master course students.
1.Energy technology assessment (engineering economics) and innovation (techno-economics)
2.Energy economics and systems analysis (econometrics)

3.Economic assessment of global warming (macroeconomics)
4.Material flow analysis (MFA), lifecycle impact assessment (LCIA) and environmental accounting
5.Mineral resource economics, waste economics
6.Environmental valuation and cost-benefit analysis (microeconomics)
7.Economics of sustainable development (development economics)

【98725】IPISE Special Seminar for Environmental Studies (DEPE) I, 1 credit, Autumn Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

【98726】IPISE Special Seminar for Environmental Studies (DEPE) II, 1 credit, Spring Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

【98727】IPISE Special Seminar for Environmental Studies (DEPE) III, 3 credits, Autumn Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

【98744】IPISE Special Seminar for Environmental Studies (DEPE) IV, 1 credit, Spring Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

【98745】IPISE Special Seminar for Environmental Studies (DEPE) V, 1 credit, Autumn Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

【98746】IPISE Special Seminar for Environmental Studies (DEPE) VI, 3 credits, Spring Semester
Department Chair

Department chair provides each student with an individual training program to acquire knowledge and techniques for environmental research which will be necessary for the student's research in the doctoral program. Student's achievement is evaluated by three referees including the academic advisor. This subject is provided exclusively for students who belong to Department of Environmental Science and Technology.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	○
98551	IPISE International Communication (DEPE) I	0-1-0	Supervisor	Autumn	#	#
98552	IPISE International Communication (DEPE) II	0-1-0	Supervisor	Spring	#	#
98553	IPISE International Communication (DEPE) III	0-1-0	Supervisor	Autumn	#	#
98554	IPISE International Communication (DEPE) IV	0-1-0	Supervisor	Spring	#	#
98555	IPISE Internship (DEPE) IA	0-0-1	Department Chair	Spring		
98556	IPISE Internship (DEPE) IB	0-0-1	Department Chair	Autumn		
98557	IPISE Internship (DEPE) IIA	0-0-2	Department Chair	Spring		
98558	IPISE Internship (DEPE) IIB	0-0-2	Department Chair	Autumn		
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		

99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory.　None: Optional.
2) #: Two of the four subjects, IPISE International Communication I through IV, must be taken.
3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).
4) ※　2014　No Lecture

4-5 Department of Built Environment (ENVENG)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
92705	IPISE Seminar (ENVENG) I	2-0-0	Supervisor	Autumn, M1	○	○
92706	IPISE Seminar (ENVENG) II	2-0-0	Supervisor	Spring, M1	○	○
92707	IPISE Seminar (ENVENG) III	2-0-0	Supervisor	Autumn, M2	○	○
92708	IPISE Seminar (ENVENG) IV	2-0-0	Supervisor	Spring, M2	○	○
92851	IPISE Seminar (ENVENG) V	2-0-0	Supervisor	Autumn, D1	○	○Dr.
92852	IPISE Seminar (ENVENG) VI	2-0-0	Supervisor	Spring, D1	○	○Dr.
92853	IPISE Seminar (ENVENG) VII	2-0-0	Supervisor	Autumn, D2	○	○Dr.
92854	IPISE Seminar (ENVENG) VIII	2-0-0	Supervisor	Spring, D2	○	○Dr.
92855	IPISE Seminar (ENVENG) IX	2-0-0	Supervisor	Autumn, D3	○	○Dr.
92856	IPISE Seminar (ENVENG) X	2-0-0	Supervisor	Spring, D3	○	○Dr.

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
92004	Design Theory of Visual Environment II	2-0-0	Y. Nakamura	Autumn (Odd Year)		
92008	Basics and Applications of Stochastic Processes	1-1-0	H. Morikawa	Spring		
92010	Intelligent Adaptive Systems	2-0-0	H. Furuya	Spring (Odd Year)		
92022	Space Environment Systems	2-0-0	H. Furuya	Spring (Even Year)		
92033	Strong Motion Prediction	1-0-0	S. Midorikawa	Spring		
92035	City/Transport Planning and the Environment	1-0-0	Y. Muromachi	Autumn		
92037	Environmental Hazard and Human Behavior	1-0-0	R. Ohno	Autumn		
92038	Passive Control of Structures against Earthquakes	1-0-0	K. Kasai	Autumn		
92023	Advanced Analysis and Design of Structures Considering Material Nonlinearity	2-0-0	K. Kasai	Spring		
92084	Dynamics of Structures	2-0-0	D. Sato	Autumn		
92043	Advanced Analysis and Design of Structures Considering Geometrical & Material Nonlinearities	1-0-0	S. Motoyui	Autumn (Odd Year)		

92046	Earthquake and Tsunami Disaster Reduction	1-0-0	TBA	Autumn		
92047	Theory of Regional Planning Process	2-0-0	T. Yai	Spring (Even Year)		
92048	Environmental Transportation Engineering	1-0-0	T. Yai	Autumn (Odd Year)		
92098	Remote Sensing and Geoinformatics for Built Environment	2-0-0	M. Matsuoka	Autumn (Even Year)		
61081	Transportation Network Analysis (Cf. Department of Civil Engineering)	2-0-0	Y. Asakura	Autumn (Even Year)		
61066	Transportation Economics (Cf. Department of Civil Engineering)	1-0-0	D. Fukuda	Autumn (Even Year)		
61014	Advanced Mathematical Methods for Infrastructure and Transportation Planning (Cf. Department of Civil Engineering)	2-0-0	D. Fukuda	Spring (Odd Year)		
62003	Architectural Preservation and Renovation	2-0-0	T. Yamazaki	Spring		
62053	Architectural Programming	2-0-0	K. Yasuda	Spring		
62054	Architectural Design Studio I	0-0-2	K. Yasuda	Spring		
62055	Architectural Design Studio II	0-0-2	K. Yasuda	Autumn		
98068	Exploration Geophysics	1-0-0	H. Yamanaka	Spring		
77016	Theory & Applications of Urban Spatial Data	2-0-0	T. Osaragi	Autumn (Odd Year)		
92715	IPISE Academic Presentation (ENVENG) I	0-1-0	Supervisor	Autumn, M1	○	○
92716	IPISE Academic Presentation (ENVENG) II	0-1-0	Supervisor	Spring, M1	○	○
92717	IPISE Academic Presentation (ENVENG) III	0-1-0	Supervisor	Autumn, M2	○	○
92718	IPISE Academic Presentation (ENVENG) IV	0-1-0	Supervisor	Spring, M2	○	○
92861	IPISE Academic Presentation (ENVENG) V	0-1-0	Supervisor	Autumn, D1	○	○Dr.
92862	IPISE Academic Presentation (ENVENG) VI	0-1-0	Supervisor	Spring, D1	○	○Dr.
92863	IPISE Academic Presentation (ENVENG) VII	0-1-0	Supervisor	Autumn, D2	○	○Dr.
92864	IPISE Academic Presentation (ENVENG) VIII	0-1-0	Supervisor	Spring, D2	○	○Dr.
92865	IPISE Academic Presentation (ENVENG) IX	0-1-0	Supervisor	Autumn, D3	○	○Dr.

92866	IPISE Academic Presentation (ENVENG) X	0-1-0	Supervisor	Spring, D3	○	○Dr.
92555	IPISE Internship (ENVENG) IA	0-0-1	Department Chair	Spring		
92556	IPISE Internship (ENVENG) IB	0-0-1	Department Chair	Autumn		
92557	IPISE Internship (ENVENG) IIA	0-0-2	Department Chair	Spring		
92558	IPISE Internship (ENVENG) IIB	0-0-2	Department Chair	Autumn		
89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property(Cf. Department of Energy Sciences)	1-0-0	Chair Y. Hayashi	Autumn		

1) ○: Compulsory. None: Optional.
2) Dr: For Doctor's course student.

【92004】Design Theory of Visual Environment II, 2 Credits, Autumn Semester, Odd Years
Y. Nakamura

This course provides the students with simulation technique and evaluation technique of visual environment, which are essential for architectural and environmental design. The students also obtain the ability to design visual environment with deep understanding of relation between real designed environment by famous architects and appearance of those real environment.
Basically students who have obtained the credit of 'Design theory of visual environment 1' can only join this class.

【92008】Basics and Applications of Stochastic Processes, 2 Credits, Spring Semester
H. Morikawa

This course discusses the basic theory of probability and stochastic process with some applications to the earthquake engineering. As the applications, techniques of analysis for array observation data of microtremors are dealt with: that is, spatial auto-correlation (SPAC) method and so on. The students are encouraged to study with the course "Introduction to time-frequency analysis". The grading policy is based on a project and its presentation.

【92010】Intelligent Adaptive Systems, 2 Credits, Spring Semester, Odd Years
H. Furuya

Basic philosophy and methodology for designing advanced structural systems as intelligent/smart systems and adaptive structure systems. Optimization techniques, multidisciplinary optimization, heuristic design methods as Genetic Algorithms and Neural Network, and structural optimization. Sensitivity analysis and computational algorithms. Knowledge of analytical mathematics and structural analysis, and experience for computational programming are strongly recommended.

1. Basic Concepts of Numerical Optimization for Engineering Design

2. Unconstrained Function Optimization
3. Linear Programming
4. Constrained Function Minimization Technique
5. Direct Methods
6. Approximation Techniques
7. Multi-Objective Optimization
8. Structural Optimization and Multi-disciplinary Optimization

【92022】Space Environment Systems, 2 Credits, Spring Semester, Even Years

H. Furuya

The mechanics of multi-body structure systems is treated to analyze the dynamics of space satellites, deployable space structures, linked space manipulators, and etc. Active control of the multi-body systems in the space environment is also introduced. The treatments of kinematics, generalized coordinates, holonomic/non-holonomic constraints are discussed. A good background in mechanics, vector analyses, and differential equations is assumed.

1. Differentiation of Vectors
2. Kinematics
3. Mass Distribution
4. Generalized Forces
5. Energy Functions
6. Formulation of Equations of Motion
7. Extraction of Information from Equations of Motion

【92033】Strong Motion Prediction, 1 Credit, Spring Semester

S. Midorikawa

The subject aims to introduce methodologies for strong motion prediction by which the design earthquake motion for seismic design of structures is specified. Topics dealt in this course include

1. Observation of strong ground motion
2. Local site effects on ground motion
3. Empirical prediction methods
4. Theoretical and Semi-empirical prediction methods
5. Seismic hazard maps

【92035】City/Transport Planning and the Environment, 1 Credit, Autumn Semester

Y. Muromachi

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

【92037】Environmental Hazard and Human Behavior, 1 Credit, Autumn Semester

R. Ohno

The primary purpose of this course is to provide students with an understanding of human perception and response to the environmental disasters. The applicability of current Environment-Behavior theories to environmental policy, planning, and design is also discussed.

【92038】Passive Control of Structures against Earthquakes, 1 Credit, Autumn Semester
K. Kasai

This course discusses various methods to evaluate effectiveness of the passive control dampers and building framing schemes. Characteristics of four main types of dampers are explained. Design and analytical methods for three types of framing systems having distinct architectural features, damper connecting schemes, as well as control efficiencies are explained. Topics are as follows:

1. Fundamental Theory on Passive Control.
2. Mechanical Characteristics of Dampers
3. Framing Systems and Their Control Efficiencies
4. Analytical Methods for Passive Control Dampers and Systems
5. Design Methods for Passive Control Dampers and Systems

【92023】Advanced Analysis and Design of Structures Considering Material Nonlinearity, 2 Credits, Spring Semester, Even Years
K. Kasai

This course discusses nonlinear force-deformation characteristics of structural members/materials and their effects on performance of the structural systems. Various static and dynamic analysis methods will be presented. Homework assignments provide extensive hands-on experience of the analytical methods, and they are designed to cultivate students' physical understanding of the nonlinear behavior. Topics are as follows:

1. Review of Linear Matrix Structural Analysis Methods.
2. Nonlinear Analysis Strategies for Truss Systems.
3. Nonlinear Beam Elements.
4. Nonlinear Analysis Strategies for Frames with Beam Elements.
5. Nonlinear Dynamic Analysis Methods.
6. Linear Analysis Using Finite Elements (may replace Chap. 5).

【92084】Dynamics of Structures, 2 Credits, Autumn Semester, Odd Years
D. Sato

This course addresses several introductory and intermediate topics in dynamic behavior of structural systems. Structures are idealized as single-degree of freedom (SDOF) or multi-degree of freedom (MDOF) systems. Special attention is given to seismic topics including earthquake response history analysis and estimation of maximum response by response spectrum analysis.

【92043】Advanced Analysis and Design of Structures Considering Geometrical & Material Nonlinearities, 1 Credit, Autumn Semester, Odd Years
S. Motoyui

This course discusses analytical methods to simulate collapse behavior of building structures. Particularly, it presents treatment of both geometrical nonlinearity and complex material nonlinearity which are essential in these analytical methods.

1. Formulation of Geometrical Nonlinearity with finite rotation.
2. Co-rotational Beam Element including Geometrical Nonlinearity

【92046】Earthquake and Tsunami Disaster Reduction, 1 Credit, Autumn Semester
TBA

To mitigate the earthquake and tsunami disaster, it is important to know them. This class is devoted to make the lecture with respect to the basics of earthquake and tsunami disaster and their mitigation. The topics of this class are follows:

1. Ground Motion
2. Earthquake Disaster
3. Tsunami Science
4. Risk Management Earthquake
5. Real-time Information
6. Earthquake Hazard Mitigation
7. Tsunami Hazard Mitigation

【92047】Theory of Regional Planning Process, 2 Credits, Spring Semester, Even years
T. Yai

Systems of Regional Planning and Transportation Planning are studied in this class. To achieve a goal of the class, first we learn about those systems in Europe, USA and Japan. Then we study on the fundamental principle of planning process and regulations/institutions. We discuss on the citizen participatory process for those planning fields. This class will cover SEA (Strategic Environmental Assessment) and refer to litigation against governmental decision at administrative court system in Japan. Besides, planning practices will be discussed with students during the class. The students are required to make two presentations by reviewing the specific planning system and its process in any country or region. The content of the class is as follows: 1) Overview, 2) National and Regional Planning systems in Japan, 3) Planning systems in Europe and USA, 4) Fundamental theory of planning process, 5) Citizen Participation and Public Involvement, 6) Administrative court system, 7) Planning and SEA process.

【92048】Environmental Transportation Engineering, 1 Credit, Autumn Semester, Odd years
T. Yai

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

【92098】Remote Sensing and Geoinformatics for Built Environment, 2 Credits, Autumn Semester, Even Years
M. Matsuoka

This course discusses remote sensing technology and basics of geographical information system (GIS) which are the generation and management tool of geo-spatial information. The monitoring procedure by onboard sensors and image analysis for evaluating built environment are explained through examples such as land classification and the detection of changed areas due to natural disasters. Topics are as follows:

1. Fundamentals of Remote Sensing and GIS
2. Satellite Observation and Sensor
3. Digital Imagery and Image Processing
4. Optical Remote Sensing
5. Basic and Application of Radar Remote Sensing
6. Urban Monitoring
7. Disaster Monitoring
8. Radar Interferometry and Surface Deformation Measurement

【61081】Transportation Network Analysis, 2 Credits, Autumn Semester, Even years
Y. Asakura

(Cf. Department of Civil Engineering)

【61066】Transportation Economics, 1 Credits, Autumn Semester, Even years
D. Fukuda

(Cf. Department of Civil Engineering)

【61014】Advanced Mathematical Methods for Infrastructure and Transportation Planning, 2 Credits, Spring Semester, Odd years
D. Fukuda

(Cf. Department of Civil Engineering)

【62003】Architectural Preservation and Renovation, 2 Credits, Spring Semester
T. Yamazaki

(Cf. Department of Architecture and Building Engineering)

【62053】Architectural Programming, 2 Credits, Spring Semester
K. Yasuda

(Cf. Department of Architecture and Building Engineering)

【62054】Architectural Design Studio I, 2 Credits, Spring Semester
K. Yasuda

(Cf. Department of Architecture and Building Engineering)

【62055】Architectural Design Studio II, 2 Credits, Autumn Semester
K. Yasuda

(Cf. Department of Architecture and Building Engineering)

【98068】Exploration Geophysics, 1 Credits, Spring Semester
H. Yamanaka

(Cf. Department of Environmental Science and Technology)

【77016】Theory & Applications of Urban Spatial Data, 2 Credits, Autumn Semester, Odd Years
T. Osaragi

(Cf. Department of Mechanical and Environmental Informatics)

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
92551	IPISE International Communication (ENVENG) I	0-1-0	Supervisor	Autumn	#	
92552	IPISE International Communication (ENVENG) II	0-1-0	Supervisor	Spring	#	
92553	IPISE International Communication (ENVENG) III	0-1-0	Supervisor	Autumn	#	
92554	IPISE International Communication (ENVENG) IV	0-1-0	Supervisor	Spring	#	
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		

1) ○: Compulsory. None: Optional.
2) # : Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.
3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).
4) ※ 2014 No Lecture

4-6 Department of Energy Sciences (DES)

Required numbers of credits for completion of the Master's program (for students who entered after April, 2012): 34 credits or more from the Graduate school courses and must meet additional requirements below;

(1) 12 credits from Research Courses provided in the Department of Energy Sciences,

(2) 12 credits or more from Courses by Departments provided in the Department of Energy Sciences,

(3) 4 credits or more from Courses by Departments provided by the other departments,

(4) 2 credits or more from Liberal Arts and General Education(G).

For more detailed information, please contact your academic advisor and department chair.

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
93705	IPISE Seminar (DES) I	2-0-0	Supervisor	Autumn, M1	○	○
93706	IPISE Seminar (DES) II	2-0-0	Supervisor	Spring, M1	○	○
93707	IPISE Seminar (DES) III	2-0-0	Supervisor	Autumn, M2	○	○
93708	IPISE Seminar (DES) IV	2-0-0	Supervisor	Spring, M2	○	○
93851	IPISE Seminar (DES) V	2-0-0	Supervisor	Autumn, D1	○	○Dr.
93852	IPISE Seminar (DES) VI	2-0-0	Supervisor	Spring, D1	○	○Dr.
93853	IPISE Seminar (DES) VII	2-0-0	Supervisor	Autumn, D2	○	○Dr.
93854	IPISE Seminar (DES) VIII	2-0-0	Supervisor	Spring, D2	○	○Dr.
93855	IPISE Seminar (DES) IX	2-0-0	Supervisor	Autumn, D3	○	○Dr.
93856	IPISE Seminar (DES) X	2-0-0	Supervisor	Spring, D3	○	○Dr.
93715	IPISE Academic Presentation (DES) I	0-1-0	Supervisor	Autumn, M1	○	○
93716	IPISE Academic Presentation (DES) II	0-1-0	Supervisor	Spring, M1	○	○
93717	IPISE Academic Presentation (DES) III	0-1-0	Supervisor	Autumn, M2	○	○
93718	IPISE Academic Presentation (DES) IV	0-1-0	Supervisor	Spring, M2	○	○
93861	IPISE Academic Presentation (DES) V	0-1-0	Supervisor	Autumn, D1	○	
93862	IPISE Academic Presentation (DES) VI	0-1-0	Supervisor	Spring, D1	○	
93863	IPISE Academic Presentation (DES) VII	0-1-0	Supervisor	Autumn, D2	○	
93864	IPISE Academic Presentation (DES) VIII	0-1-0	Supervisor	Spring, D2	○	
93865	IPISE Academic Presentation (DES) IX	0-1-0	Supervisor	Autumn, D3	○	
93866	IPISE Academic Presentation (DES) X	0-1-0	Supervisor	Spring, D3	○	

1) ○: Compulsory. None: Optional.

2) Dr: For Doctoral course student.

(+) Year: The Year recommended to take the subject.

M1: 1st year in Master's course
M2: 2nd year in Master's course
D1: 1st year in Doctoral course
D2: 2nd year in Doctoral course
D3 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
93559	Fundamentals for Energy Sciences (DES)	2-0-0	Eiki HOTTA, Tetsuji OKAMURA, Hiroshi AKATSUKA, Jun HASEGAWA	Autumn (Odd Years)		
93560	Fundamentals for Energy Conversion(DES)	2-0-0	Yoshihiro OKUNO, Keiko WAKI, Yasuo HASEGAWA	Autumn (Even Years)		
93561	Fundamentals for Energy and Environment(DES)	2-0-0	Takao NAGASAKI, Feng XIAO, Yoshiyuki OGURI, Yoshihisa MATSUMOTO Tetsuya SUEKANE	Autumn (Even Years)		
93562	Fundamentals for Nuclear Energy Sources(DES)	2-0-0	Toshiyuki KOHNO, Kazuhiko HORIOKA	Autumn (Odd Years)		
93021	Fundamentals for Plasma Science	2-0-0	Akitoshi OKINO, Eiki HOTTA, Kazuhiko HORIOKA	Autumn (Even Years)		
93029	Numerical Simulation for Fluid Dynamics	2-0-0	Feng XIAO, Takao NAGASAKI, Takayuki AOKI	Spring (Odd Years)		
93047	Advanced Course of Energy Science and Engineering	2-0-0	Academic Advisors	Autumn (Even Years)		
93057	Specific Interdisciplinary Subject in Energy Sciences A	0-2-0	Yoshihiro OKUNO	Spring	※	※
93058	Specific Interdisciplinary Subject in Energy Sciences B	0-2-0	Yoshihiro OKUNO	Autumn	※	※
89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	

93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn	○	
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
93731	IPISE Advanced Experiments and Exercises (DES) I	0-0-1	Supervisor	Autumn, M1	○	○
93732	IPISE Advanced Experiments and Exercises (DES) II	0-0-1	Supervisor	Spring, M1	○	○
93733	IPISE Advanced Experiments and Exercises (DES) III	0-0-1	Supervisor	Autumn, M2	○	○
93734	IPISE Advanced Experiments and Exercises (DES) IV	0-0-1	Supervisor	Spring, M2	○	○
93555	IPISE Internship (DES) IA	0-0-1	Department Chair	Spring		
93556	IPISE Internship (DES) IB	0-0-1	Department Chair	Autumn		
93557	IPISE Internship (DES) IIA	0-0-2	Department Chair	Spring		
93558	IPISE Internship (DES) IIB	0-0-2	Department Chair	Autumn		
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese.					

1) ○: Compulsory. None: Optional.

2) Dr: For Doctoral course student.

(+) Year: The Year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3 3rd year in Doctoral course

3) ※: This course can only be registered by the students of the ACEEES, and must be registered from other Departments.

【93559】Fundamentals for Energy Sciences (DES), 2 Credits, Autumn Semester, Odd Years

E. Hotta, T. Okamura, H. Akatsuka, J.Hasegawa

This subject provides the fundamental knowledge, which is required of all the students in the Department of Energy Sciences, of Electromagnetics, Circuit theory, Thermodynamics, Statistical thermodynamics, Fluid flow, Quantum mechanics, and Special theory of relativity.

1. Basic laws of electromagnetics 1 (Electrostatics)
2. Basic laws of electromagnetics 2 (Magnetostatics)
3. Basic theory of electrical circuit 1 (DC circuit)
4. Basic theory of electrical circuit 2 (AC circuit and elements)
5. Basic laws of thermodynamics and fundamentals of heat engine
6. Fundamentals of statistical thermodynamics (Maxwell - Boltzmann distribution)
7. Fundamentals of heat transfer phenomena
8. Fundamental equations for fluid flow
9. Atomic physics based upon quantum mechanics - Schroedinger equation and wave mechanics
10. Harmonic oscillator by wave and matrix mechanics
11. Uncertainty principle and principle of quantum mechanics

12. Principle of special theory of relativity 1 - Lorentz transformation
13. Principle of special theory of relativity 2 - Special relativistic dynamics and electromagnetics

【93560】Fundamentals for Energy Conversion (DES), 2 Credits, Autumn Semester, Even Years
Y. Okuno, K. Waki, Y. Hasegawa

The lecture provides fundamental knowledge on energy conversion. The process of energy conversion is comprehensively discussed based on electrical, mechanical and chemical phenomena. This lecture also covers current technologies for converting heat, light and chemical energy into electrical energy and state of the art developments on the energy system. The major topics are fundamentals and developments in magneto-hydro-dynamic (MHD) electrical power generation, fuel cells, solar cells, capacitors, and distributed energy systems.

【93561】Fundamentals for Energy and Environment (DES), 2 Credits, Autumn Semester, Even Years
T. Nagasaki, F. Xiao, Y. Oguri, Y. Matsumoto, T.Suekane

This course provides fundamental knowledge on the energy and environment related issues. The major topics include global energy balance, environmental problems and their assessment for regional and global atmosphere, atmospheric diffusion and numerical modeling, material circulation in the geosphere including unconventional hydrocarbon recovery, emission control of environmental pollutant due to fossil fuels, energy utilization and the environmental loading, utilization of nuclear energy and its impact on environment, biological effects of radiation and underlying molecular mechanisms.

【93562】Fundamentals for Nuclear Energy Sources (DES), 2 Credits, Autumn Semester, Odd Years
T. Kohno, K. Horioka

The lecture provides fundamental knowledge on nuclear energy systems. This includes nuclear physics, plasma physics, engineering aspects of nuclear power plants, and issues for fusion reactors. A prospect of future energy systems and related environmental issues are also discussed.

【93021】Fundamentals for Plasma Science, 2 Credits, Autumn Semester, Even Years
A. Okino, E. Hotta, K. Horioka

This course offers knowledge on fundamentals for plasma science and technology. It includes plasma generation, governing equations of plasmas, magneto hydrodynamics, characteristics of plasma, plasma diagnostics and recent topics in plasma applications.

【93029】Numerical Simulation for Fluid Dynamics, 2 Credits, Spring Semester, Odd Years
F. Xiao, T. Nagasaki, T. Aoki

This English course presents the fundamental knowledge and applications of computational fluid dynamics. The students are expected to be able to use numerical methods to solve some typical problems in fluid dynamics through class instructions, exercises and programming practices.

【93047】Advanced Course of Energy Science and Engineering, 2 Credits, Autumn Semester, Even Years
Academic Advisors (Dept. of Energy Sciences)

This course aims to broaden the knowledge on energy science and engineering. The students are provided an overview on trends and state-of-the-art technology in the field of energy science.

【93057（A）, 93058（B）】 Specific Interdisciplinary Subject in Energy Sciences A, B, 2 Credits, (A) Spring Semester, (B) Autumn Semester
Y. Okuno

Understandings of energy environment science, energy conversion engineering, high energy density science, such as advanced technology of energy production, conversion, transportation and utilization, are the key concepts to bring about technology breakthroughs relating to fundamental energy and environmental issues. This exercise/drill course utilizes a self-study approach on the subjects for students seeking to broaden their knowledge on Energy Sciences and to help acquire sufficient problem-solving skills to conduct research on advanced technology of energy production, conversion, transportation and utilization.

【93059】Historical Review of Intellectual Property, 1 Credit, Autumn Semester
Y.Hayashi

The lecture provides a historical review of the patent system. It consists of the establishment of the first patent law in Venetia, the importance of the patent for the Industrial revolution in British, and for developing new frontiers in America. The beginning of the Japanese Patent system in Meiji is also included.

【93705-93708, 93851-93856】IPISE Seminar (DES) I-X, 2 Credits (for each)
I, III, V, VII, IX : Autumn Semester;　II, IV, VI, VIII, X : Spring Semester
Supervisor

This seminar is given at laboratory of student's academic advisor, and conducted through reading and introducing original papers, reading of selected books, practicing presentation/discussion on scientific meeting

【93715-93718, 93861-93866】IPISE Academic Presentation (DES) I-X, 1 Credits (for each)
I, III, V, VII, IX : Autumn Semester;　II, IV, VI, VIII, X : Spring Semester
Supervisor

This course provides an opportunity for student to give her/his presentation on their progress of research activities in front of her/his supervisor. This includes presentations in domestic and/or international scientific meetings, symposiums, and/or seminars on her/his research field.

【93731-93734】IPISE Advanced Experiments and Exercises (DES) I-IV, 1 Credits (for each)
I, III : Autumn Semester;　II, IV : Spring Semester
Supervisor

This course is given at the laboratory of student's academic advisor, and conducted through discussion on the research field including the presentation on her/his progress of study concerning their Mater thesis.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
93551	IPISE International Communication (DES) I	0-1-0	Supervisor	Autumn	#	
93552	IPISE International Communication (DES) II	0-1-0	Supervisor	Spring	#	
93553	IPISE International Communication (DES) III	0-1-0	Supervisor	Autumn	#	
93554	IPISE International Communication (DES) IV	0-1-0	Supervisor	Spring	#	
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.

2) #: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.

3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

4) ※ 2014 No Lecture

4-7 Department of Environmental Chemistry and Engineering (CHEMENV)

Research Courses

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
87705	IPISE Seminar (CHEMENV) I	0-2-0	Supervisor	Autumn, M1	○	○
87706	IPISE Seminar (CHEMENV) II	0-2-0	Supervisor	Spring, M1	○	○
87707	IPISE Seminar (CHEMENV) III	0-2-0	Supervisor	Autumn, M2	○	○
87708	IPISE Seminar (CHEMENV) IV	0-2-0	Supervisor	Spring, M2	○	○
87851	IPISE Seminar (CHEMENV) V	0-2-0	Supervisor	Autumn, D1	○	○Dr
87852	IPISE Seminar (CHEMENV) VI	0-2-0	Supervisor	Spring, D1	○	○Dr
87853	IPISE Seminar (CHEMENV) VII	0-2-0	Supervisor	Autumn, D2	○	○Dr
87854	IPISE Seminar (CHEMENV) VIII	0-2-0	Supervisor	Spring, D2	○	○Dr
87855	IPISE Seminar (CHEMENV) IX	0-2-0	Supervisor	Autumn, D3	○	○Dr
87856	IPISE Seminar (CHEMENV) X	0-2-0	Supervisor	Spring, D3	○	○Dr

1) ○: Compulsory. None: Optional.

2) Dr: For Doctoral course student.

(+)Year: The Year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
87072	Macromolecular and Supramolecular Chemistry	2-0-0	M. Yoshizawa, K. Osakada	Autumn (Even Years)	#	#
87073	Topics in Advanced Inorganic Materials	2-0-0	T. Imaoka, M. Tanabe	Autumn (Even Years)	#	#
87074	Reaction Systems Engineering	2-0-0	H. Ueda, H. Seki	Autumn (Even Years)	#	#
87075	Advanced Organic and Inorganic Physical Chemistry	2-0-0	T. Baba, D. Takeuchi	Autumn (Odd Years)	#	#
87076	Biochemistry Standing on Elements	2-0-0	T. Hisabori , K.Wakabayashi	Autumn (Odd Years)	#	#
87077	Chemistry for Environment	2-0-0	E. Kobatake , K. Motokura	Autumn (Odd Years)	#	#
87715	IPISE Academic Presentation (CHEMENV) I	0-1-0	Supervisor	Autumn, M1	○	○
87716	IPISE Academic Presentation (CHEMENV) II	0-1-0	Supervisor	Spring, M1	○	○

87717	IPISE Academic Presentation (CHEMENV) III	0-1-0	Supervisor	Autumn, M2	○	○
87718	IPISE Academic Presentation (CHEMENV) IV	0-1-0	Supervisor	Spring, M2	○	○
87861	IPISE Academic Presentation (CHEMENV) V	0-1-0	Supervisor	Autumn, D1	○	○Dr
87862	IPISE Academic Presentation (CHEMENV) VI	0-1-0	Supervisor	Spring, D1	○	○Dr
87863	IPISE Academic Presentation (CHEMENV) VII	0-1-0	Supervisor	Autumn, D2	○	○Dr
87864	IPISE Academic Presentation (CHEMENV) VIII	0-1-0	Supervisor	Spring, D2	○	○Dr
87865	IPISE Academic Presentation (CHEMENV) IX	0-1-0	Supervisor	Autumn, D3	○	○Dr
87866	IPISE Academic Presentation (CHEMENV) X	0-1-0	Supervisor	Spring, D3	○	○Dr
87555	IPISE Internship (CHEMENV) IA	0-0-1	Department Chair	Spring		
87556	IPISE Internship (CHEMENV) IB	0-0-1	Department Chair	Autumn		
87557	IPISE Internship (CHEMENV) IIA	0-0-2	Department Chair	Spring		
87558	IPISE Internship (CHEMENV) IIB	0-0-2	Department Chair	Autumn		
	Courses in other Departments and Courses in Education Academies, except for courses Lectured in Japanese.					

1) ○: Compulsory. None: Optional.
2) #: Three of these subjects must be taken.
3) Dr: For Doctoral course student.

(+)Year: The Year recommended to take the subject.

M1: 1st year in Master's course
M2: 2nd year in Master's course
D1: 1st year in Doctoral course
D2: 2nd year in Doctoral course

【87072】Macromolecular and Supramolecular Chemistry, 2 Credits, Autumn Semester (Even Years)
M. Yoshizawa, K. Osakada

This lecture covers the topics from organic chemistry to macromolecular chemistry to supramolecular chemistry for the purpose of understanding design, synthesis, structure, and properties of organic molecules, large organic compounds, and their assemblies. The recent topics in this field will be also discussed.

【87073】Topics in Advanced Inorganic Materials, 2 Credits, Autumn Semester (Even Years)
T. Imaoka, M. Tanabe

This course covers current topics regarding advanced inorganic materials from standpoint of synthesis and characterization, and their versatile physicochemical properties.

【87074】Reaction Systems Engineering, 2 Credits, Autumn Semester (Even Years)
H.Ueda, H. Seki

Fundamental physical chemistry, mass transfer, and heat transfer are reviewed. The application of chemical reaction engineering and process engineering are also introduced.

【87075】Advanced Organic and Inorganic Physical Chemistry, 2 Credits, Autumn Semester (Odd Years)
T. Baba, D. Takeuchi

Recent topics on organic and inorganic chemistry are discussed from the viewpoint of physical chemistry. The contents involve structures and reactions of organic compounds (properties of chemical bond, reaction intermediate) and reaction kinetics.

【87076】Biochemistry Standing on Elements, 2 Credits, Autumn Semester (Odd Years)
T. Hisabori, K.Wakabayashi

In the living cell, various elements are involved into the construction of various molecules. In this lecture, basis of biochemistry is lectured stand on these elements, which may give you a new scope of biochemistry. In addition, the concepts of thermodynamics in the cell and bioenergetics are lectured as well.

【87077】Chemistry for Environment, 2 Credits, Autumn Semester (Odd Years)
E.Kobatake, K. Motokura,

Fundamental and applied chemistry for environmental protection and prevention are lectured. Current topics, such as recycle of carbon dioxide, are discussed.

【87705-87708, 87851-87856】IPISE Seminar (CHEMENV) I－X, 2 Credits (for each)
I, III, V, VII, IX : Autumn Semester; II, IV, VI, VIII, X : Spring Semester
Supervisor

This seminar is given at laboratory of student’s academic advisor, and conducted through reading and introducing original papers, reading of selected books, practicing presentation/discussion on scientific symposium.

【87715-87718, 87861-87866】IPISE Academic Presentation (CHEMENV) I-X, 1 Credit (for each)
I, III, V, VII, IX : Autumn Semester; II, IV, VI, VIII, X : Spring Semester
Supervisor

An opportunity for student to give her/his presentation on their progress of research activities in front of her/his supervisor. This includes presentation in domestic and/or international meetings, congresses, symposiums, and/or seminars on her/his research field.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester	Remarks (See footnotes)	
					IGP(A)	IGP(C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
87551	IPISE International Communication (CHEMENV) I	0-1-0	Supervisor	Autumn	##	##
87552	IPISE International Communication (CHEMENV) II	0-1-0	Supervisor	Spring	##	##
87553	IPISE International Communication (CHEMENV) III	0-1-0	Supervisor	Autumn	##	##
87554	IPISE International Communication (CHEMENV) IV	0-1-0	Supervisor	Spring	##	##
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		

99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.

2) ##: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.

3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

4) ※ 2014 No Lecture

===== <**Advanced Course of Information Technology and System Sciences**> =====

4-8 Department of Electronics and Applied Physics (E&AP)

Research Courses

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP (A)	IGP (C)
89705	IPISE Seminar (E&AP) I	2-0-0	Supervisor	Autumn, M1	○	○
89706	IPISE Seminar (E&AP) II	2-0-0	Supervisor	Spring, M1	○	○
89707	IPISE Seminar (E&AP) III	2-0-0	Supervisor	Autumn, M2	○	○
89708	IPISE Seminar (E&AP) IV	2-0-0	Supervisor	Spring, M2	○	○
89851	IPISE Seminar (E&AP) V	2-0-0	Supervisor	Autumn, D1	○	○Dr.
89852	IPISE Seminar (E&AP) VI	2-0-0	Supervisor	Spring, D1	○	○Dr.
89853	IPISE Seminar (E&AP) VII	2-0-0	Supervisor	Autumn, D2	○	○Dr.
89854	IPISE Seminar (E&AP) VIII	2-0-0	Supervisor	Spring, D2	○	○Dr.
89855	IPISE Seminar (E&AP) IX	2-0-0	Supervisor	Autumn, D3	○	○Dr.
89856	IPISE Seminar (E&AP) X	2-0-0	Supervisor	Spring, D3	○	○Dr.
89725	Experiment (E&AP) I	0-0-1	Supervisor	Autumn, M1	○	○
89726	Experiment (E&AP) II	0-0-1	Supervisor	Spring, M1	○	○
89727	Experiment (E&AP) III	0-0-1	Supervisor	Autumn, M2	○	○
89728	Experiment (E&AP) IV	0-0-1	Supervisor	Spring, M2	○	○

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP (A)	IGP (C)
89115	Linear and Nonlinear Optics in Advanced Materials	2-0-0	Kotaro KAJIKAWA	Spring (Odd Year)		
89133	Fundamentals of light and matter IIb	1-0-0	Hiro Munekata	Spring		
93059	Historical Review of Intellectual Property	1-0-0	Y. HAYASHI	Autumn		
89135	Seminar for Cultivating International Understandings I	0-2-0	Kotaro KAJIKAWA	Autumn	○	○

89136	Seminar for Cultivating International Understandings II	0-1-0	Kotaro KAJIKAWA	Spring	○	○
89103	VLSI Engineering II	2-0-0	Kazuya MASU, N. Ishihara, K. Machida, K. Goto, H. Ito	Spring		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
89715	IPISE Academic Presentation (E&AP) I	0-1-0	Supervisor	Autumn, M1	○	○
89716	IPISE Academic Presentation (E&AP) II	0-1-0	Supervisor	Spring, M1	○	○
89717	IPISE Academic Presentation (E&AP) III	0-1-0	Supervisor	Autumn, M2	○	○
89718	IPISE Academic Presentation (E&AP) IV	0-1-0	Supervisor	Spring, M2	○	○
89861	IPISE Academic Presentation (E&AP) V	0-1-0	Supervisor	Autumn, D1	○	○Dr.
89862	IPISE Academic Presentation (E&AP) VI	0-1-0	Supervisor	Spring, D1	○	○Dr.
89863	IPISE Academic Presentation (E&AP) VII	0-1-0	Supervisor	Autumn, D2	○	○Dr.
89864	IPISE Academic Presentation (E&AP) VIII	0-1-0	Supervisor	Spring, D2	○	○Dr.
89865	IPISE Academic Presentation (E&AP) IX	0-1-0	Supervisor	Autumn, D3	○	○Dr.
89866	IPISE Academic Presentation (E&AP) X	0-1-0	Supervisor	Spring, D3	○	○Dr.
89555	IPISE Internship (E&AP) IA	0-0-1	Department Chair	Spring		
89556	IPISE Internship (E&AP) IB	0-0-1	Department Chair	Autumn		
89557	IPISE Internship (E&AP) IIA	0-0-2	Department Chair	Spring		
89558	IPISE Internship (E&AP) IIB	0-0-2	Department Chair	Autumn		
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese.					

1) ○: Compulsory. None: Optional.
2) Dr: For Doctor's course student.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

【89115】Linear and Nonlinear Optics in Advanced Materials, 2 credits, Spring Semester, Odd Years: English/ Even Years: Japanese
K. Kajikawa

1. The understanding of optical constants of dielectrics, metals and semiconductors, on the basis of the Maxwell equations.
2. Propagation of light in crystals, liquid crystals and nonlinear optical materials for the understanding of functional optical materials, including computer simulations.
3. Introduction to nanophotonics and surface plasmon optics.

【89133】Fundamentals of light and matter IIb, 1 credit, Spring Semester
H. Munekata

In order to carry out fundamental research on novel electronic, optical, and magnetic materials and devices, you have to understand the behavior of electrons in solids. This class aims at learning wave-like aspect of electrons in crystals, excitation of solids with low- (electrical) to high- (optical) frequency electromagnetic waves, and resultant optical properties of solids. Energy bands in the most advanced materials, in particular low dimension systems, will also be reviewed.

【89103】VLSI Engineering II, 2 credits, Spring Semester
K. Masu, N. Ishihara, K. Machida, K. Goto, H. Ito

We lecture RF transceiver systems, RF CMOS circuits, analog CMOS circuits, integrated CMOS/MEMS technology, and ultra-low-power CMOS circuits as a state-of-the-art integrated circuit technology. This class reviews examples and future trends of the integrated circuit design.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP (A)	IGP (C)
96053	Modern Japan	1-0-0	To be announced	Spring	○	○
89551	IPISE International Communication (E&AP) I	0-1-0	Supervisor	Autumn	#	#
89552	IPISE International Communication (E&AP) II	0-1-0	Supervisor	Spring	#	#
89553	IPISE International Communication (E&AP) III	0-1-0	Supervisor	Autumn	#	#
89554	IPISE International Communication (E&AP) IV	0-1-0	Supervisor	Spring	#	#
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		

99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.

2) #: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.

3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

4) ※ 2014 No Lecture

4-9 Department of Mechano-Micro Engineering (MECMIC)

Research Courses

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
83705	IPISE Seminar (MECMIC)I	2-0-0	Supervisor	Autumn, M1	○	
83706	IPISE Seminar (MECMIC)II	2-0-0	Supervisor	Spring, M1	○	
83707	IPISE Seminar (MECMIC)III	2-0-0	Supervisor	Autumn, M2	○	
83708	IPISE Seminar (MECMIC)IV	2-0-0	Supervisor	Spring, M2	○	
83851	IPISE Seminar (MECMIC)V	2-0-0	Supervisor	Autumn, D1	○Dr.	○Dr.
83852	IPISE Seminar (MECMIC)VI	2-0-0	Supervisor	Spring, D1	○Dr.	○Dr.
83853	IPISE Seminar (MECMIC)VII	2-0-0	Supervisor	Autumn, D2	○Dr.	○Dr.
83854	IPISE Seminar (MECMIC)VIII	2-0-0	Supervisor	Spring, D2	○Dr.	○Dr.
83855	IPISE Seminar (MECMIC)IX	2-0-0	Supervisor	Autumn, D3	○Dr.	○Dr.
83856	IPISE Seminar (MECMIC)X	2-0-0	Supervisor	Spring, D3	○Dr.	○Dr.
83715	IPISE Academic Presentation (MECMIC)I	0-1-0	Supervisor	Autumn, M1	*	
83716	IPISE Academic Presentation (MECMIC)II	0-1-0	Supervisor	Spring, M1	*	
83717	IPISE Academic Presentation (MECMIC)III	0-1-0	Supervisor	Autumn, M2	*	
83718	IPISE Academic Presentation (MECMIC)IV	0-1-0	Supervisor	Spring, M2	*	
83861	IPISE Academic Presentation (MECMIC)V	0-1-0	Supervisor	Autumn, D1	*	**
83862	IPISE Academic Presentation (MECMIC)VI	0-1-0	Supervisor	Spring, D1	*	**
83863	IPISE Academic Presentation (MECMIC)VII	0-1-0	Supervisor	Autumn, D2	*	**
83864	IPISE Academic Presentation (MECMIC)VIII	0-1-0	Supervisor	Spring, D2	*	**
83865	IPISE Academic Presentation (MECMIC)IX	0-1-0	Supervisor	Autumn, D3	*	**
83866	IPISE Academic Presentation (MECMIC)X	0-1-0	Supervisor	Spring, D3	*	**

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

3) *: One subject among IPISE Academic Presentation I through IV, and another subject among Academic Presentation V through X must be taken.

4) **: One subject among IPISE Academic Presentation V through X, must be taken.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
83067	Theory of Robotics A	1-0-0	Toru OMATA Toshio TAKAYAMA	☐Autumn		
83068	Theory of Robotics B	1-0-0	Toru OMATA	■Autumn		
83036	Advanced Mechanical Systems Design	1-0-0	Mikio HORIE	☐Autumn (Odd year)		
83069	Advanced Solid Mechanics	1-0-0	Chiaki SATO	■Autumn (Even year)		
83070	Process Measurement and Control A	1-0-0	Toshiharu KAGAWA , Kenji KAWASHIMA Kotaro TADANO	☐Autumn (Even year)		
83071	Process Measurement and Control B	1-0-0	Toshiharu KAGAWA , Kenji KAWASHIMA Kotaro TADANO	■Autumn (Even year)		
83072	Advanced Course of Ultimate Mechanical System A	1-0-0	Tadahiko SHINSHI	☐Autumn (Even year)		
83073	Advanced Course of Ultimate Mechanical System B	1-0-0	Tadahiko SHINSHI	■Autumn (Even year)		
89135	Seminar for Cultivating International Understandings Ⅰ	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings Ⅱ	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
83555	IPISE Internship (MECMIC) IA	0-0-1	Department Chair	Spring		
83556	IPISE Internship (MECMIC) IB	0-0-1	Department Chair	Autumn		
83557	IPISE Internship (MECMIC) IIA	0-0-2	Department Chair	Spring		
83558	IPISE Internship (MECMIC)IIB	0-0-2	Department Chair	Autumn		
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese					

☐…will be offered first half of the semester.

■…will be offered second half of semester.

【83067】Theory of Robotics A, 1 credits, ☐Autumn Semester

T. Omata, T. Takayama

This course provides basic knowledge on robot analysis and design mainly for planar manipulators. The

topics include kinematics and statics of planar serial and parallel manipulators, and mechanisms of robots.

【83068】Theory of Robotics B, 1 credits, ■Autumn Semester
T. Omata

This course provides basic knowledge on robot analysis and design mainly for spatial manipulators. The topics include kinematics and statics of spatial serial and parallel manipulators, and dynamics of manipulators. This course also discusses advanced topics on robotics such as medical robotics, welfare robotics, etc.

【83036】Advanced Mechanical Systems Design, 1 credits, □Autumn Semester(Odd years only)
M. Horie

The mechanical systems composed of machine elements, for example, actuators, sensors, mechanisms, etc., are introduced and their design methods are discussed in the fields of kinematics of machinery.

【83069】Advanced Solid Mechanics, 1 credits, ■Autumn Semester(Even years only)
C. Sato

Advanced topics on solid mechanics are explained and discussed in this course to provide extensive knowledge on non-linear elasticity, plasticity and viscoelasticity described with tensor analysis.

【83070】Process Measurement and Control A, 1 credits, □Autumn Semester(Even years only)
T. Kagawa, K. Kawashima, K. Tadano

Sensors, control methods and instruments used in process control are introduced.

【83071】Process Measurement and Control B, 1 credits, ■Autumn Semester(Even years only)
T. Kagawa, K. Kawashima, K. Tadano

Applications of process control are introduced and their dynamics are discussed.

【83072】Advanced Course of Ultimate Mechanical System A, 1 credits, □Autumn Semester(Even years only)
T. Shinshi

Basic knowledge on mechanical and electrical devices is introduced in order to design and fabricate ultra-precision, micro, high-speed, simple or integrated mechanisms.

【83073】Advanced Course of Ultimate Mechanical System B, 1 credits, ■Autumn Semester(Even years only)
T. Shinshi

Basic knowledge on precision and micro mechatronic systems is introduced in order to design and fabricate ultra-precision, micro, high-speed, simple or integrated mechanical systems.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
83551	IPISE International Communication (MECMIC) I	0-1-0	Supervisor	Autumn	#	
83552	IPISE International Communication (MECMIC) II	0-1-0	Supervisor	Spring	#	
83553	IPISE International Communication (MECMIC) III	0-1-0	Supervisor	Autumn	#	
83554	IPISE International Communication (MECMIC) IV	0-1-0	Supervisor	Spring	#	
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory. None: Optional.

2) #: Two of the four subjects, IPISE International Communication I through IV, must be taken.

3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

4) ※ 2014 No Lecture

4-10 Department of Computational Intelligence and Systems Science (CISS)

In the master's program, 30 or more credits must be acquired. In these credits, 18 or more credits must be taken in Research Courses and Courses by Departments. Also 2 or more credits must be taken in Liberal Arts and General Education(G).

In the doctoral program, Compulsory Subjects (Dr.) of all semesters when the candidate is enrolled must be taken.

Research Courses

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
94705	IPISE Seminar (CISS) I	2-0-0	Supervisor	Autumn, M1	○	○
94706	IPISE Seminar (CISS) II	2-0-0	Supervisor	Spring, M1	○	○
94707	IPISE Seminar (CISS) III	2-0-0	Supervisor	Autumn, M2	○	○
94708	IPISE Seminar (CISS) IV	2-0-0	Supervisor	Spring, M2	○	○
94851	IPISE Seminar (CISS) V	2-0-0	Supervisor	Autumn, D1	○	○Dr
94852	IPISE Seminar (CISS) VI	2-0-0	Supervisor	Spring, D1	○	○Dr
94853	IPISE Seminar (CISS) VII	2-0-0	Supervisor	Autumn, D2	○	○Dr
94854	IPISE Seminar (CISS) VIII	2-0-0	Supervisor	Spring, D2	○	○Dr
94855	IPISE Seminar (CISS) IX	2-0-0	Supervisor	Autumn, D3	○	○Dr
94856	IPISE Seminar (CISS) X	2-0-0	Supervisor	Spring, D3	○	○Dr

1) ○: Compulsory Subjects.
2) Dr: For Doctor's course student.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
94072	Advanced Topics in Systems Life-Sciences I	2-0-0	M. Yamamura et al.	Autumn		
94073	Advanced Topics in Socio-economic Sciences I	2-0-0	H. Deguchi et al.	Autumn		

94074	Advanced Topics in Intelligence Sciences I	2-0-0	K. Nitta et al.	Autumn		
94075	Advanced Topics in Mathematical Information Sciences I	2-0-0	Y. Kabashima et al.	Autumn		
94101	Advanced Topics in Systems Life-Sciences II	2-0-0	K. Nakamura et al.	Spring		
94102	Advanced Topics in Socio-economic Sciences II	2-0-0	T. Terano et al.	Spring		
94103	Advanced Topics in Intelligence Sciences II	2-0-0	Y. Miyake et al.	Spring		
94104	Advanced Topics in Mathematical Information Sciences II	2-0-0	S. Watanabe et al.	Spring		
94090	Topics in Translational Biomedical Informatics	1-1-0	A. Konagaya	Autumn		
94082	Special Lecture on Computational Intelligence and Systems Science I	1-0-0	To be announced	Spring		
94715	IPISE Academic Presentation (CISS) I	0-1-0	Supervisor	Autumn, M1	○	○
94716	IPISE Academic Presentation (CISS) II	0-1-0	Supervisor	Spring, M1	○	○
94717	IPISE Academic Presentation (CISS) III	0-1-0	Supervisor	Autumn, M2	○	○
94718	IPISE Academic Presentation (CISS) IV	0-1-0	Supervisor	Spring, M2	○	○
94861	IPISE Academic Presentation (CISS) V	0-1-0	Supervisor	Autumn, D1	○	○Dr
94862	IPISE Academic Presentation (CISS) VI	0-1-0	Supervisor	Spring, D1	○	○Dr
94863	IPISE Academic Presentation (CISS) VII	0-1-0	Supervisor	Autumn, D2	○	○Dr
94864	IPISE Academic Presentation (CISS) VIII	0-1-0	Supervisor	Spring, D2	○	○Dr
94865	IPISE Academic Presentation (CISS) IX	0-1-0	Supervisor	Autumn, D3	○	○Dr
94866	IPISE Academic Presentation (CISS) X	0-1-0	Supervisor	Spring, D3	○	○Dr
94555	IPISE Internship (CISS) IA	0-0-1	Department Chair	Spring		
94556	IPISE Internship (CISS) IB	0-0-1	Department Chair	Autumn		
94557	IPISE Internship (CISS) IIA	0-0-2	Department Chair	Spring		
94558	IPISE Internship (CISS) IIB	0-0-2	Department Chair	Autumn		

1) ○: Compulsory Subjects.
2) Dr: For Doctor's course student.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

【94072】

Advanced Topics in Systems Life-Sciences I, 2 Credits, Autumn Semester

○Prof. Masayuki Yamamura, Prof. Akihiko Konagaya, Prof. Kiyohiko Nakamura, Assoc. Prof. Daisuke Kiga, Assoc. Prof. Eizo Miyashita, Coordinate Prof. Takanori Kigawa, Coordinate Prof. Atsushi Mochizuki, Coordinate Prof. Takanori Shibata, Coordinate Assoc. Prof. Teruki Honma, Coordinate Assoc. Prof. Taro Toyoizumi, Assist. Prof. Ken Komiya, Assist. Prof. Takuma Tanaka, Assoc. Prof. Daniel Berrar

The objective of this course is to introduce the state of art on Systems Life-Sciences. Topics are chosen from Bioinformatics, Genomic Researches, System Biology, Synthetic Biology, mathematical Biology, Biophysics, DNA Nano Engineering, and Brain Sciences.

【94073】

Advanced Topics in Socio-economic Sciences I, 2 Credits, Autumn Semester

○Prof. Hiroshi Deguchi, Prof. Takao Terano, Prof. Kaoru Hirota, Assoc. Prof. Isao Ono, Assoc. Prof. Misako Takayasu, Coordinate Prof. Yasuhiro Kanatani, Coordinate Prof. Itsuki Noda, Coordinate Prof. Gaku Yamamoto, Coordinate Prof. Kazuo Yano, Coordinate Assoc. Prof. Tomoya Saito, Assist. Prof. Takashi Yamada, Assist. Prof. Manabu Ichikawa

This course, “Advanced Topics in Socio-economic Sciences I” is a graduate level course for students interested in interdisciplinary research for socio-economic systems as the sciences of the artificial. The course will provide students with an advanced survey of emerging topics in the multidisciplinary field of socio-economic sciences and its application as a design science.

【94074】

Advanced Topics in Intelligence Sciences I, 2 Credits, Autumn Semester

○Prof. Katsumi Nitta, Prof. Hiroshi Nagahashi, Prof. Yoshihiro Miyake, Prof. Makoto Sato, Prof. Takamichi Nakamoto, Coordinate Prof. Seiji Yamada, Assoc. Prof. Hiroya Takamura, Assoc. Prof. Shoichi Hasegawa, Assist. Prof. Shogo Okada, Assist. Prof. Kenichiro Ogawa, Assist. Prof. Katsuhito Akahane, Assist. Prof. Fang yan Dong.

The purpose of this course is to present how intelligence sciences are applied to practical systems. By different lectures, wide range of topics of intelligence sciences, such as artificial intelligence, man-machine interactive systems, intelligent image processing systems, intelligent robotics and so on, are presented.

【94075】

Advanced Topics in Mathematical Information Sciences I, 2 Credits, Autumn Semester

○Prof. Yoshiyuki Kabashima, Prof. Sumio Watanabe, Coordinate Prof. Kenji Fukumizu, Coordinate Prof. Shotaro Akaho, Assoc. Prof. Hideaki Ishii, Assoc. Prof. Toshiaki Murofushi, Assoc. Prof. Osamu Hasegawa, Assoc. Prof. Toru Aonishi, Assoc. Prof. Yuichi Nagata, Assoc. Prof. Masahiro Takinoue, Coordinate Assoc. Prof. Shiro Ikeda, Coordinate Assoc. Prof. Yoichi Motomura, Assist. Prof. Keisuke Yamazaki.

The objective of this course is to introduce mathematical notions and methodologies which are developing in the current frontiers of research on computational intelligence and systems science in conjunction with their application examples. Topics are chosen from learning theory, fuzzy theory, control theory, information theory, mathematical and computational statistics, theory of evolutionary computing and etc.

【94101】

Advanced Topics in Systems Life-Sciences II, 2 Credits, Spring Semester

○Prof. Kiyohiko Nakamura, Prof. Masayuki Yamamura, Prof. Akihiko Konagaya, Assoc. Prof. Daisuke Kiga, Assoc. Prof. Eizo Miyashita, Coordinate Prof. Takanori Kigawa, Coordinate Prof. Atsushi Mochizuki, Coordinate Prof. Takanori Shibata, Coordinate Assoc. Prof. Teruki Honma, Coordinate Assoc. Prof. Taro Toyoizumi, Assist. Prof. Ken Komiya, Assist. Prof. Takuma Tanaka, Assoc. Prof. Daniel Berrar

The objective of this course is to introduce the state of art on Systems Life-Sciences. Topics are chosen from Bioinformatics, Genomic Researches, System Biology, Synthetic Biology, mathematical Biology, Biophysics, DNA Nano Engineering, and Brain Sciences. The contents of this lecture II are different from

those of I.

【94102】
Advanced Topics in Socio-economic Sciences II, 2 Credits, Spring Semester
○Prof. Takao Terano, Prof. Hiroshi Deguchi, Prof. Kaoru Hirota, Assoc. Prof. Isao Ono, Assoc. Prof. Misako Takayasu, Coordinate Prof. Yasuhiro Kanatani, Coordinate Prof. Itsuki Noda, Coordinate Prof. Gaku Yamamoto, Coordinate Prof. Kazuo Yano, Coordinate Assoc. Prof. Tomoya Saito, Assist. Prof. Takashi Yamada, Assist. Prof. Manabu Ichikawa

This course, "Advanced Topics in Socio-economic Sciences II" is a graduate level course for students interested in interdisciplinary research for socio-economic systems as the sciences of the artificial. The course will provide students with an advanced survey of emerging topics in the multidisciplinary field of socio-economic sciences and its application as a design science. The contents of this lecture II are different from those of I.

【94103】
Advanced Topics in Intelligence Sciences II, 2 Credits, Spring Semester
○Prof. Yoshihiro Miyake, Prof. Hiroshi Nagahashi, Prof. Katsumi Nitta, Prof. Makoto Sato, Prof. Takamichi Nakamoto, Coordinate Prof. Seiji Yamada, Assoc. Prof. Hiroya Takamura, Assoc. Prof. Shoichi Hasegawa, Assist. Prof. Shogo Okada, Assist. Prof. Kenichiro Ogawa, Assist. Prof. Katsuhito Akahane, Assist. Prof. Fang yan Dong.

The purpose of this course is to present how intelligence sciences are applied to practical systems. By different lectures, wide range of topics of intelligence sciences, such as artificial intelligence, man-machine interactive systems, intelligent image processing systems, intelligent robotics and so on, are presented. The contents of this lecture II are different from those of I.

【94104】
Advanced Topics in Mathematical Information Sciences II, 2 Credits, Spring Semester
○Prof. Sumio Watanabe, Prof. Yoshiyuki Kabashima, Coordinate Prof. Kenji Fukumizu, Coordinate Prof. Shotaro Akaho, Assoc. Prof. Hideaki Ishii, Assoc. Prof. Toshiaki Murofushi, Assoc. Prof. Osamu Hasegawa, Assoc. Prof. Toru Aonishi, Assoc. Prof. Yuichi Nagata, Assoc. Prof. Masahiro Takinoue, Coordinate Assoc. Prof. Shiro Ikeda, Coordinate Assoc. Prof. Yoichi Motomura, Assist. Prof. Keisuke Yamazaki.

The objective of this course is to introduce mathematical notions and methodologies which are developing in the current frontiers of research on computational intelligence and systems science in conjunction with their application examples. Topics are chosen from learning theory, fuzzy theory, control theory, information theory, mathematical and computational statistics, theory of evolutionary computing and etc. The contents of this lecture II are different from those of I.

【94090】Topics in Translational Biomedical Informatics , 2 Credit, Autumn Semester
A. Konagaya et al.

This intensive course is a one unit lesson designed primarily for graduate students to study advanced topics in the field of biomedical informatics using video lectures provided by the Palaver Seminar of Harvard Medical School. The class is a mixture of a video lecture and discussion with faculties.
Grading criteria: Report 50%, Participation 50%
Test: None

【94082】Special Lecture on Computational Intelligence and Systems Science I, 1 credit, Spring Semester
To be announced.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
94551	IPISE International Communication (CISS) I	0-1-0	Supervisor	Autumn	#	#
94552	IPISE International Communication (CISS) II	0-1-0	Supervisor	Spring	#	#
94553	IPISE International Communication (CISS) III	0-1-0	Supervisor	Autumn	#	#
94554	IPISE International Communication (CISS) IV	0-1-0	Supervisor	Spring	#	#
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) ○: Compulsory Subjects.

2) #: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.

3) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

4) ※ 2014 No Lecture

4-11 Department of Information Processing (IP)

Requirements for Master's Course Study (Tentative):

Research Courses 16 Credits or more

Seminar 8 Credits

Research work Subject 8 Credits

Courses by Departments 12 Credits or more

Lectures provided by Information Processing Dept.

Lectures provided by other departments

Liberal Arts and General Education(G) 2 Credits or more

Research Courses

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
88705	IPISE Seminar (IP) I	2-0-0	Supervisor	Autumn, M1	○	○
88706	IPISE Seminar (IP) II	2-0-0	Supervisor	Spring, M1	○	○
88707	IPISE Seminar (IP) III	2-0-0	Supervisor	Autumn, M2	○	○
88708	IPISE Seminar (IP) IV	2-0-0	Supervisor	Spring, M2	○	○
88851	IPISE Seminar (IP) V	2-0-0	Supervisor	Autumn, D1	○	○Dr.
88852	IPISE Seminar (IP) VI	2-0-0	Supervisor	Spring, D1	○	○Dr.
88853	IPISE Seminar (IP) VII	2-0-0	Supervisor	Autumn, D2	○	○Dr.
88854	IPISE Seminar (IP) VIII	2-0-0	Supervisor	Spring, D2	○	○Dr.
88855	IPISE Seminar (IP) IX	2-0-0	Supervisor	Autumn, D3	○	○Dr.
88856	IPISE Seminar (IP) X	2-0-0	Supervisor	Spring, D3	○	○Dr.
88725	IP Special Experiment (IP) I	0-0-2	Supervisor	Autumn, M1	○	○
88726	IP Special Experiment (IP) II	0-0-2	Supervisor	Spring, M1	○	○
88715	IPISE Academic Presentation (IP) I	0-1-0	Supervisor	Autumn, M1	○	○
88716	IPISE Academic Presentation (IP) II	0-1-0	Supervisor	Spring, M1	○	○
88717	IPISE Academic Presentation (IP) III	0-1-0	Supervisor	Autumn, M2	○	○
88718	IPISE Academic Presentation (IP) IV	0-1-0	Supervisor	Spring, M2	○	○
88861	IPISE Academic Presentation (IP) V	0-1-0	Supervisor	Autumn, D1	○	○Dr.
88862	IPISE Academic Presentation (IP) VI	0-1-0	Supervisor	Spring, D1	○	○Dr.
88863	IPISE Academic Presentation (IP) VII	0-1-0	Supervisor	Autumn, D2	○	○Dr.
88864	IPISE Academic Presentation (IP) VIII	0-1-0	Supervisor	Spring, D2	○	○Dr.
88865	IPISE Academic Presentation (IP) IX	0-1-0	Supervisor	Autumn, D3	○	○Dr.
88866	IPISE Academic Presentation (IP) X	0-1-0	Supervisor	Spring, D3	○	○Dr.

1) ○: Compulsory. None: Optional.

2) Dr: For Doctor's course student.

(+)Year :The year recommended to take the subject.

M1: 1st year in Master's course

M2: 2nd year in Master's course

D1: 1st year in Doctoral course

D2: 2nd year in Doctoral course

D3: 3rd year in Doctoral course

Courses by Departments

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
88003	Basic Sensation Informatics	2-0-0	K. Uchikawa, H. Kaneko, M. Kashino, M. Kawasaki J. Watanabe	Spring (Odd Year)		
88009	Visual Information Processing	2-0-0	H. Kaneko, K. Uchikawa, I. Sato, J. Watanabe	Autumn (Even Year)		
88021	Fundamentals of Digital Signal Processing	2-0-0	T. Kobayashi, M. Yamaguchi, N. Sugino	Spring (Odd Year)		
88028	Speech and Language Processing	2-0-0	T. Kobayashi, M. Okumura	Autumn (Even Year)		
88023	Optical Imaging and Image Processing	2-0-0	M. Yamaguchi	Autumn (Even Year)		
88024	Statistical Models of Brain and Parallel Computation	2-0-0	I. Kumazawa	Autumn (Odd Year)		
88102	Medical Image Informatics	2-0-0	T. Obi	Autumn (Odd Year)		
88107	Fundamentals on VLSI Systems	2-0-0	N. Sugino	Spring (Even Year)		
88108	Advanced VLSI Systems	2-0-0	N. Sugino	Autumn (Odd Year)		
88109	Intelligent Information Systems	2-0-0	T. Ito K. Sumita K. Aida	Autumn (Even Year)		
88110	Ultrasonic Electronics	2-0-0	K. Nakamura M. Tabaru	Spring (Even Year)		
88111	Micro-Acoustic Systems	2-0-0	M. Kurosawa, K. Nakamura	Autumn (Odd Year)		
88031	Language Engineering	2-0-0	M. Okumura	Spring (Odd Year)		
88032	Computational Brain	2-0-0	Y. Koike	Autumn (Odd Year)		
88555	IPISE Internship (IP) IA	0-0-1	Department Chair	Spring		
88556	IPISE Internship (IP) IB	0-0-1	Department Chair	Autumn		
88557	IPISE Internship (IP) IIA	0-0-2	Department Chair	Spring		
88558	IPISE Internship (IP) IIB	0-0-2	Department Chair	Autumn		

89135	Seminar for Cultivating International Understandings I	0-2-0	K. Kajikawa	Autumn	○	
89136	Seminar for Cultivating International Understandings II	0-1-0	K. Kajikawa	Spring	○	
93059	Historical Review of Intellectual Property	1-0-0	Y. Hayashi	Autumn		
36005	Strategic Management of Technology	2-0-0	K. Miyazaki	Spring		
	Courses in other Departments and Courses in Education Academies, except for courses lectured in Japanese.					

1) ○: Compulsory. None: Optional.

【88003】Basic Sensation Informatics, 2 credits, Spring Semester, Odd years
K. Uchikawa, H. Kaneko, M. Kashino, M.Kawasaki, J. Watanabe

It is described how human perceptual system obtains, transfers, analyzes and integrates information from the outside world so that a final perceptual image can be created in human brain. Fundamental aspects of visual and other sensory systems, including the structures, methods for measuring the perceptual responses and psychophysical and physiological functions, are explained showing many experimental data.

【88009】Visual Information Processing, 2 credits, Autumn Semester, Even years
H. Kaneko, K. Uchikawa, I. Sato, J. Watanabe

The aspects and mechanisms of visual information processing for space perception, color perception, motion perception etc. are described showing recent studies. The development of visual system, the interaction between visual and other sensory systems, the methods for measuring, analyzing and modeling the functions of visual system are also described.

【88021】Fundamentals of Digital Signal Processing, 2 credits, Spring Semester, Odd years
T. Kobayashi, M. Yamaguchi, N. Sugino

This course provides basic knowledge on digital signal processing. Digital signal processing plays an important role in analysis of various information systems. It is assumed that the student is familiar with complex variables and Fourier theory. Topics include discrete-time signals and systems, sampling theorem, z-transform, discrete-time Fourier transform (DFT), fast Fourier transform (FFT) algorithms, digital filters, and multi-dimensional signal processing.

【88028】Speech and Language Processing, 2 credits, Autumn Semester, Even years
T. Kobayashi, M. Okumura

This course provides an introduction to speech signal processing and natural language processing. Topics include fundamentals and recent advances in the theory and practice of speech and language processing, such as hidden Markov models, automatic speech recognition, text-to-speech synthesis, speech coding, morphological analysis, syntactic analysis, and information retrieval.

【88023】Optical Imaging and Image Processing, 2 credits, Autumn Semester, Even years

M. Yamaguchi

Based on the knowledge of the diffraction and interference of light, optical imaging theory, and two-dimensional Fourier transform, the fundamentals of optical imaging systems and digital image processing are described. The applications in image analysis, restoration and reconstruction are also introduced.

【88024】Statistical Madels of Brain and Parallel Computation, 2 credits, Autumn Semester, Odd years
I. Kumazawa

Some attempts are introduced to analyze and understand principals behind brain function and massively parallel computation. Methods of statistical physics and probabilistic computation are lectured in addition to programming exercises to confirm the behavior of the parallel systems based on these methods.

【88102】Medical Image Informatics, 2 credits, Autumn Semester, Odd years
T. Obi

This course will feature an image and information aspects of a medical engineering, such as a mechanism of X-ray CT, SPECT and PET, image reconstruction methods etc. In addition, a diagnostic technique will be will be presented in the lecture.

【88107】Fundamentals on VLSI Systems, 2 credits, Spring Semester, Even years
N. Sugino

The course will provide the students with an understanding basic knowledge for analysis and design of VLSI systems. Key topics are fundamentals on logic and sequential circuits, functional and arithmetic units, registers and memories, and etc. By use of above components, basics of processor architecture are also discussed.

【88108】Advanced VLSI Systems, 2 credits, Autumn Semester, Odd years
N. Sugino

This course provides both hardware and software issues for modern microprocessor architectures. Nowadays, VLSI technology plays very important roles in information systems. Various applications are implemented on alternative architectures; some provide faster computation and some give lower power consumption. In order to understand and evaluate these architectures, this lecture provides fundamental issues on microprocessor architectures as well as modern design techniques to implement various applications efficiently. In addition, design automation methodologies for various architectures are introduced. Furthermore, software issues such as operating systems and compilers are given.

【88109】Intelligent Information Systems, 2 credits, Autumn Semester, Even years
T. Ito, K. Sumita, K.Aida

As advanced computerized society becomes reality, a demand for hyper-functional, hyper-efficient intelligent information systems is skyrocketed in every corners of the society and therefore development of such systems is a crucial technological challenge. In particular, R&D and technological innovation for intelligent

processing, such as recognition and understanding of media information that is represented by a picture and a sound, and their hyper-functional implementation are rapidly advancing and their importance grows exponentially. This lecture will discuss the newest technologies and R&D trends of the intelligent information systems, with its focus on the media information processing.

【88110】Ultrasonic Electronics, 2 credits, Spring Semester, Even years
K. Nakamura, M. Tabaru

This lecture presents the fundamentals for generation, transmission, radiation and detection of ultrasonic waves as well as the unique effects of intense ultrasonics and their applications.
Theories of elastic wave phenomena, piezoelectricity and piezoelectric materials, and equivalent circuit modeling of transducers are given in this course.

【88111】Micro-Acoustic Systems, 2 credits, Autumn Semester, Odd years
M. Kurosawa, K. Nakamura

Micro actuators and sensors based on elastic vibration and/or elastic wave are lectured. Starting from materials and fabrication technologies for MEMS (micro electro mechanical systems) devices, structures and principles of the transducers are introduced. A couple of sensors and actuators are studied in detail to obtain clear understanding for actual devices. For this purpose, modeling methods of the piezoelectric electro mechanical system and opto mechatro system are discussed.

【88031】Language Engineering, 2 credits, Spring Semester, Odd years
M. Okumura

This lecture introduces natural language processing technologies that can realize analyzing and processing natural language on computers, and their application technologies, such as information retrieval. Information extraction, text summarization, question answering, and text mining.

【88032】Computational Brain, 2 credits, Autumn Semester, Odd years
Y. Koike

Human brain adapt the environment by learning the appropriate actions. In this lecture, the methodology that clarifies the function of the brain based on the computational neuroscience is described, especially, optimization of movement, control, learning mechanisms.

Liberal Arts and General Education(G)

No.	Subject	Credit	Chair	Semester, Year(+) (See footnotes)	Remarks (See footnotes)	
					IGP(A)	IGP(C)
96053	Modern Japan	1-0-0	Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee	Spring	○	
88551	IPISE International Communication (IP) I	0-1-0	Supervisor	Autumn	#	

88552	IPISE International Communication (IP) II	0-1-0	Supervisor	Spring	#	
88553	IPISE International Communication (IP) III	0-1-0	Supervisor	Autumn	#	
88554	IPISE International Communication (IP) IV	0-1-0	Supervisor	Spring	#	
99405	Technical Writing 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99406	Technical Writing 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99412	Technical Writing 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99413	Technical Writing 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99403	Technical Discussion 1	0-2-0	D. Ricinschi D. Berrar	Spring		
99404	Technical Discussion 2	0-2-0	D. Ricinschi D. Berrar	Autumn		
99410	Technical Discussion 3 ※	0-2-0	D. Ricinschi D. Berrar	Autumn		
99411	Technical Discussion 4 ※	0-2-0	H. Gonzales D. Ricinschi	Spring		
99416	Critical Thinking	2-0-0	D. Ricinschi H. Gonzales	Autumn		
99415	Scientific Communication	2-0-0	D. Berrar D. Ricinschi	Spring		
99417	Global Trends in Science and Technology	2-0-0	H. Gonzales D. Berrar	Autumn		
99408	Ethics for Scientists and Engineers	2-0-0	M. Yamamura	Autumn		

1) #: Two of the four subjects, i.e. IPISE International Communication I through IV, must be taken.

2) 'Technical Writing', 'Technical Discussion' can be registered only by the students who belong to IPISE, IGP(A) and Innovative Platform for Education and Research course (IPER).

3) ※ 2014 No Lecture

5. Syllabus of the subjects common to all Departments

【89135】Seminar for Cultivating International Understandings I, 2 Credits, Autumn Semester
Chair K. Kajikawa

The purpose of this seminar is to provide a platform for international collaboration, mutual understanding and cooperation, while fostering the development of global human resources. The seminar consists of (a) informal research meetings as well as a “science cafe”, (b) Mini-internship and (c) Corporative work between the foreign and Japanese students.

【89136】Seminar for Cultivating International Understandings II, 1 Credits, Spring Semester
Chair K. Kajikawa

The purpose of this seminar is to provide a platform for international collaboration, mutual understanding and cooperation, while fostering the development of global human resources. The seminar consists of (a) informal research meetings as well as a “science cafe”, (b) Mini-internship and (c) Corporative work between the foreign and Japanese students.
The student who got the credit of Seminar for Cultivating International Understandings I can take this class.

【93059】Historical Review of Intellectual Property, 1 credit, Autumn Semester
Chair Y. Hayashi

The lecture provides a historical review of the patent system. It consists of the establishment of the first patent law in Venetia, the importance of the patent for the Industrial revolution in British, and for developing new frontiers in America. The beginning of the Japanese Patent system in Meiji is also included.

【36005】Strategic Management of Technology, 2 credits, Spring Semester
K. Miyazaki

This course aims to teach the basic concepts, tools and theories needed for strategic management of technology. The topics covered include, innovation models, sectoral models of innovation, technological competence building, technological diversification strategy, technology portfolio management, globalization and management of research and development. Students are assessed by class participation, group presentations, debate, tests and short reports.

【96053】Modern Japan, 1 Credit, Spring Semester
Masahiko Hara, Itaru Kamiya, Olaf Karthaus, Haiwon Lee

Japan is regarded as an industrialized country, however it has many unique characteristics which differ from those of Western-industrialized countries. Selected foreign and Japanese authorities will lecture on how they view contemporary Japan, with special regard to research activities and career paths in the various fields of science and technology.

【**】IPISE International Communication (Department code) I-IV, 1 Credit for each Semester,
(I, III: Autumn Semester; II, IV: Spring Semester)
Supervisor

A seminar for students from different countries of IPISE to exchange information on background and objective their research.

*Also refer to **4. Curriculum and Syllabus for each Department** if there is additional indication.

**The number of the subject should be the same with that shown in 4.Curriculum and Syllabus for each Department.

【**】IPISE Academic Presentation (Department code) I-X, 1 Credit for each Semester
(I, III, V, VII, IX : Autumn Semester; II, IV, VI, VIII, X : Spring Semester)
Supervisor

An opportunity for student to give her/his presentation on their progress of research activities in front of her/his supervisor.

*Also refer to **4. Curriculum and Syllabus for each Department** if there is additional indication.

**The number of the subject should be the same with that shown in 4.Curriculum and Syllabus for each Department.

【**】IPISE Seminar (Department code) I－X, 2 Credits for each Semester
(I, III, V, VII, IX : Autumn Semester; II, IV, VI, VIII, X : Spring Semester)
Supervisor

Group seminar based on her/his research progress lead by supervisor(s).

*Also refer to **4. Curriculum and Syllabus for each Department** if there is additional indication.

**The number of the subject should be the same with that shown in 4.Curriculum and Syllabus for each Department.

【**】IPISE Internship (Department code) IA, IB, IIA, IIB
IA: 1 Credit, Spring Semester
IB: 1 Credit, Autumn Semester
IIA: 2 Credits, Spring Semester
IIB: 2 Credits, Autumn Semester
Department Chair

Internship at national research laboratories and domestic private industries for exchange.

**The number of the subject should be the same with that shown in 4.Curriculum and Syllabus for each Department.

【99405】Technical Writing 1, 2 credits, Spring Semester
【99406】Technical Writing 2, 2 credits, Autumn Semester
【99412】Technical Writing 3, 2 credits, Autumn Semester ※ 2014 No Lecture
【99413】Technical Writing 4, 2 credits, Spring Semester ※ 2014 No Lecture
D. Ricinschi, D. Berrar, H. Gonzales

To be one of the outstanding scientists in the international field, it is necessary to be able to write scholarly scientific and technical papers in English. Writing academic reports while learning the fundamental and advanced writing techniques is the principal aim of this course.

【99403】Technical Discussion 1, 2 credits, Spring Semester
【99404】Technical Discussion 2, 2 credits, Autumn Semester
【99410】Technical Discussion 3, 2 credits, Autumn Semester ※ 2014 No Lecture
【99411】Technical Discussion 4, 2 credits, Spring Semester ※ 2014 No Lecture
D. Ricinschi, D. Berrar, H. Gonzales

Practical exercises through English discussions and oral presentations will help students develop their English proficiency and eventually play an active role in the international field of research.

【99416】Critical Thinking, 2 credits, Autumn Semester
D. Ricinschi, H. Gonzales, D. Berrar

The course aims to demonstrate the importance of thinking critically about the various issues in science and technology that students are likely to encounter during their future careers. Students will learn to ask the right questions when confronted with their peers' ideas and opinions, as well as to quickly find ambiguities, lack of evidence, weaknesses in argumentation, contradictions, and omissions in both written and oral communications. The course includes a discussion of the various approaches to the scientific inquiry, such as induction, deduction, and abduction, and logical fallacies. In addition to regular lectures, the course will have an important interactive component where students will practice constructive criticism on written/oral communications chosen by the instructor. the ultimate goal of this course will be to help students to improve the logical soundness of their own argumentations.

【99415】Scientific Communication, 2 credits, Spring Semester
D. Berrar, D. Ricinschi, H. Gonzales

This course covers topics of scientific oral and written communication in English. The course objective is to develop and refine the students' skills that are required for scientific publications and oral presentations. The main topics include (i) how to write and publish a scientific paper and (ii) how to give academic presentations at international conferences. The course objectives will be met through lectures and practice in writing exercises, oral presentations, and classroom discussions.

【99417】Global Trends in Science and Technology, 2 credits, Autumn Semester
H. Gonzales, D. Berrar, D. Ricinschi

This course aims to enhance the students' knowledge of the current global concerns in relation to progress in science and technology as well as the scientific principles and techniques needed to address the reigning global issues. This will give students a basic understanding of the ongoing worldwide research and development in science and technology. Aside from the regular lectures, there will be a series of discussions on selected topics from science and technology that will allow students to freely express themselves as they share their respective insights. After completion of the course, the students are expected to have acquired an increased level of interest in and awareness of advances in scientific and technological research.

【99408】Ethics for Scientists and Engineers, 2 credits, Autumn Semester
M. Yamamura

This omnibus lecture series covers topics related to research ethics, such as research misconduct and its prevention. Experts will explain research ethics by citing concrete examples from various fields, such as environmental policy and residential participation, bioethics, and the history of safety standards for gene recombination, the Helsinki Declaration (international ethical principles for biomedical research involving human subjects), examples of research misconduct (e.g., fabrication and falsification of data by Jan Hendrik Schön, Bell Labs), and ethics in information society. In small interactive groups of 3-5, students will present selected topics on ethics for scientists and engineers, which will then be discussed during the class.