[Title]			[Instructor]		
Field Research for Environmental and Social System Science			Intensive		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTK701	2	Environmental and Social System Science Course		／	English／Japanese

[Outline and purpose]

This lecture is aimed to train practical ability of broad view and problem solving by participating and practicing students in research and development cooperated with outside organizations such as enterprises and government.

[Objectives]

By participating students and conducting exercises in cooperation with outside organizations such as corporations and government agencies, students can acquire practical skills in broad view and problem solving by participating in exercises.

[Requirements]

To understand obligation of confidentiality of information that students learned in research and development and to understand ethics concerning development.

[Evaluation]

Based on the student's research presentation, the supervisor in charge will evaluate the grade.

[Textbooks]

Instructed as necessary

[References]

Instructed as necessary

[Schedule]

Intensive lecture form
The actual form shall be any of the following related to the teacher in charge.
1) Collaborative research conducted at the Graduate School General Research Division and outside organization
2) Research and development in collaboration with other organizations outside the university
We aim to participate in exercises for 60 hours and be able to exceed the grade level.
At the end we hold a recital and the students announce the results. The instructor in charge will evaluate the grade based on the contents of the presentation.

[Title]			[Instructor]		
Advanced Exercises for Environmental and Social System Science Ⅰ			Each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTK750	2	Environmental and Social System Science Course		Tue.／Ⅳ	English／Japanese

[Outline and purpose]

This lecture is a seminar exercise that conducts research on basic literature in fields directly related to research themes. Through broad learning of fundamental knowledge on research themes and ongoing progress report and discussion to the supervising group, the purpose of this lecture is to let students acquire a viewpoint of significance, role, target setting, methodology to advance research.

[Objectives]

To establish a viewpoint in advancing research such as research significance, role, goal setting, methodology.

[Requirements]

To acquire the research ability to collect, understand and evaluate academic papers in order to know what level of cutting-edge is at home and abroad in the research theme you are about to work on.

[Evaluation]

100%: Content of research/investigation and discussion

[Textbooks]

Research papers related to research themes will be introduced occasionally.

[References]

Research papers related to research themes will be introduced occasionally.

[Schedule]

In order to deepen knowledge of the research theme and foster students' efforts, strict guidance will be conducted in seminar form.

[Title]			[Instructor]		
Advanced Exercises for Environmental and Social System Science Ⅱ			Each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTK751	2	Environmental and Social System Science Course		／	English／Japanese

[Outline and purpose]

This is a seminar exercise that conducts research and research on the latest literature in fields directly related to the research theme. Students will report and discuss ongoing research survey with the supervisor group, conduct research and examine the results.

[Objectives]

To understand the state-of-the-art level of research topics to be undertaken, and acquire advanced research capabilities such as how to conduct new discoveries and technological development beyond that level in any way.

[Requirements]

To acquire the research ability to collect, understand and evaluate academic papers in order to know what level of cutting-edge is at home and abroad in the research theme you are about to work on.

[Evaluation]

100%: Content of research/investigation and discussion

[Textbooks]

Research papers related to research themes will be introduced occasionally.

[References]

Research papers related to research themes will be introduced occasionally.

[Schedule]

In order to deepen knowledge of the research theme and foster students' efforts, strict guidance are conducted in seminar form.

[Title]			[Instructor]		
Advanced Course of Disaster Mitigation and Damage Reduction			Takeyasu Suzuki / Tadashi Suetsug		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTL701	2	Environmental and Social System Science Course	2nd Semester	Fri.／III	Japanese

[Outline and purpose]

Purpose of this lecture is to study on the management method of disaster prevention and mitigation, targeting earthquake, flood disaster etc. In the lecture, present status of disaster, problem of disaster prevention and mitigation, viewpoint and method of watershed management and regional management technique are explained.

[Objectives]

・Student can understand the viewpoint of disaster prevention and mitigation by grasping present status of disaster
・Student can apply viewpoint of watershed management to practical business and research
・Student can apply regional management technique to practical business and research
・Student can obtain the basic knowledge for disaster prevention and mitigation

[Requirements]

It is desirable to obtain basic knowledge of disaster prevention engineering, comprehensive river engineering and information technology, but it is not imperative to attend these lectures. Student can understand the content of lecture by reading relating technical report and book.

[Evaluation]

・Report：50%
・Presentation and discussion：50%

[Textbooks]

Not specified

[References]

・末次忠司：水害から治水を考える、技報堂出版（ISBN：978-4-7655-1838-3）(in Japanese)
・鈴木猛康：巨大災害を乗り切る地域防災力、静岡学術出版（ISBN：978-4-90385-970-5）(in Japanese)
・鈴木猛康：大災害から命を守る知恵、術、仕組み、静岡学術出版（ISBN：978-4-86474-044-9）(in Japanese)

[Schedule]

Schedule is following as

・Introduction
・Present status of disaster
・Watershed management
・Regional management technique
・Disaster prevention and mitigation method
・Problem of countermeasures against disaster

Lecture will be done by intensive course after arrangement of schedule with students.

[Title]			[Instructor]		
Advanced Infrastructure Engineering			Junji Yoshida/Satoshi Goto		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTL703	2	Environmental and Social System Science Course	2nd Semester	Mon.／II	Japanese

[Outline and purpose]

This course provides fundamentals knowledge on mechanics for designing and analyzing structures such as bridges and geotechnical structures.

In the former part of the course, we study about the basic concepts of continuum mechanics and structural mechanics. Then, Energy methods for the structures are studied in order to derive boundary value problems of the problems.

In the latter part of the course, mechanics of soil and its modeling are studied in detail, and we try to solve some exercises, which will be available for practical problems of those mechanics.

[Objectives]

- to understand the definition of stress and strain
- to derive boundary value problems of the structure, based on the energy method.
- to explain how to obtain dynamic properties of soil through experiments, and how to approximate the experimental results by models.
- to understand liquefaction from experimental and analytical viewpoints.

[Requirements]

Fundamental knowledge of structural mechanics and soil mechanics.

[Evaluation]

Report on the contents of the lesson: 50%
Term examination : 50%

[Textbooks]

ISHIHARA, K., Soil Behaviour in Earthquake Geotechnics, Clarendon Press, ISBN:978-0198562245

[References]

IrvingH Shames, Energy and Finite Element Methods In Structural Mechanics: SI Units, Routledge, ISBN:B075F9M7HX

[Schedule]

1. Introduction (Assoc. Prof. Yoshida)
2. Concept of Continuum (Assoc. Prof. Yoshida)
3. Stress and equilibrium equations (Assoc. Prof. Yoshida)
4. Strain and deformation (Assoc. Prof. Yoshida)
5. Linear elastic solids (Assoc. Prof. Yoshida)
6. Variational principle (Assoc. Prof. Yoshida)
7. Energy method for continuum and structural mechanics (Assoc. Prof. Yoshida)
8. Outline of dynamic properties of soils
9. Experimental approach for dynamics of soils (Assoc. Prof. Goto)
10. Experimental approach for dynamics of soils (Assoc. Prof. Goto)
11. Theory for dynamics of soils (Assoc. Prof. Goto)
12. Theory for dynamics of soils (Assoc. Prof. Goto)
13. Experiments for liquefaction (Assoc. Prof. Goto)
14. Modeling for liquefaction (Assoc. Prof. Goto)
15. Summary (Assoc. Prof. Yoshida, Assoc. Prof. Goto)

[Title]			[Instructor]		
Advanced Environmental Sanitary Engineering			Hidehiro Kaneko / Kazuhiro Mori		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTL704	2	Environmental and Social System Science Course	1st Semester	Thu.／I	English／Japanese

[Outline and purpose]

This class is consist of two parts. The first part deals with basics of water quality management and second part is on basics of waste management and establishment of recycling-based society. Exercise and discussion will be performed to bring up application skill.

[Objectives]

1. To understand basic concept, technologies and acquire skills to propose a solution on water quality management.
2. To understand basic concepts, general techniques and to acquire a capability of dealing with a problem relating to waste management system

[Requirements]

[Evaluation]

1. Reports and/or short examination; Understanding level of the contents in each part will be evaluated.; 100%

[Textbooks]

[References]

[Schedule]

Part I: Water quality management (Mori)
1. Basics of environmental conservation
2. Water quality indexes
3. Basics of water purification technologies
4. Physicochemical treatment
5. Biological treatment
6. Present issues and future prospects
7. Exercises for water quality control

Part II: Waste management (Kaneko)
8. History of waste management and issues waiting solution
9. Establishment of recycling-based society and relating and legislative system (1)Legal framework and Waste Disposal Law
10. Establishment of recycling-based society and relating and legislative system (2)Recycling relevant laws
11. Waste management techniques (1)Collection and transport
12. Waste management techniques (2)Incineration
13. Waste management techniques (3)Gasification and melting
14. Waste management techniques (4)Final disposal
15. Waste management techniques (5)Measuring analysis

[Title]			[Instructor]		
Advanced Water Quality Assessment			Yasushi Sakamoto / Futaba Kazama / Kei Nishida / Eiji Haramoto		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM702	2	Environmental and Social System Science Course	2nd Semester	Fri.／II	English／Japanese

[Outline and purpose]

Environmental issues and the applied methodologies are outlined specifically on terrestrial environments such as groundwater, river or lake. Natural and human-induced water contents, estimations of pollutant load and health risk/guideline, modeling water quality incorporated with infiltration/flow/runoff processes are discussed. English is potentially used.

[Objectives]

- Understanding basic concept of water quality control and calculation of guideline values
- Understanding basic concept of water quality modelling and capable of introducing the equations
- Utilizing above knowledge to interpret real situation of water environment

[Requirements]

Basics of water quality is desirable.

[Evaluation]

Quiz and assignments: 70%
Attitude in the class: 30%

[Textbooks]

Not designated. Related literatures or research examples will be introduced when necessary.

[References]

Not designated. Related literatures or research examples will be introduced when necessary.

[Schedule]

1 Introduction (Sakamoto, Kazama, Nishida, and Haramoto)
2 Health-related items (Haramoto)
3 Outline of microbiological indicators (Haramoto)
4 Future of microbiological indicators (Haramoto)
5 Outline of living environmental items (Nishida)
6 Future of living environmental items (Nishida)
7 Methods for water quality monitoring and principle of loading estimation (Nishida)
8 Environmental impact assessment (EIA) in Japan (Sakamoto)
9 Examples of EIA: groundwater pollution (Sakamoto)
10 Tools for EIA: model simulation (Sakamoto)
11 Examples of governmental procedures for setting water quality standards: health items (Kazama)
12 Examples of governmental procedures for setting water quality standards: items for conservation of the living environment (Kazama)
13 Management of water quality and activities of citizens (Kazama)
14 Group discussion 1 (Sakamoto, Kazama, Nishida, and Haramoto)
15 Group discussion 2 (Sakamoto, Kazama, Nishida, and Haramoto)

[Title]			[Instructor]		
Advanced Hydrology and Water Resources			Yasushi Sakamoto / Keiichi Masutani /Hiroshi Ishidaira		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM703	2	Environmental and Social System Science Course	1st Semester	Thu.／II	English／Japanese

[Outline and purpose]

The aim of the lecture is to learn mechanism and modeling of water flows. The lecture starts from describing basic equations of fluid motion, followed by 1-dimensional water flow equations and storage type water dynamics modeling. The lecture deals with not only theoretical description of water flow modeling but also its numerical solution technique. The topics treated in the lecture are crucial for understanding water flows and river basin environmental science. The lecture is mainly given in Japanese while English is also used when needed.

[Objectives]

1. To understand basic equations of fluid motion and their derivation.
2. To understand 1-dimensional open channel flow equations and their derivation.
3. To understand kinematic wave model equations and their derivation.
4. To understand storage type water dynamics model and their derivation.
5. To understand basic of numerical solution technique for water flow models.

[Requirements]

Basic knowledge on hydraulics, hydrology and calculus.

[Evaluation]

Report: 40%
Final exam: 40%
Attendance and Attitude: 20%

[Textbooks]

[References]

[Schedule]

1. Introduction
2. Basic equations of fluid motion
3. Basic equations of material transport
4. Runoff process and water quality
5. Vertical movement of soil water and solute transport
6. Groundwater flow and solute transport
7. River flow process
8. Evapotranspiration: theory
9. Evapotranspiration: model
10. River basin hydrological model: conceptual model and lumped model
11. River basin hydrological model: distributed model
12. Modeling of water use and water control
13. Water resources in Japan
14. Water resources in the world
15. Summary

[Title]			[Instructor]		
Advanced Environmental Treatment Technology			Futaba Kazama / Kazuhiro Mori / Tadashi Toyama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM704	2	Environmental and Social System Science Course	2nd Semester	Thu.／II	English／Japanese

[Outline and purpose]

The purpose of this lecture is to learn the purification/remediation technologies for polluted soil and water. They include physicochemical technology, biological technology and ecological technology for removal of organic compounds, nutrients (nitrogen and phosphorus), heavy metals and persistent organic pollutants. In this lecture, we will learn the technologies for energy/material recovery from solid waste/wastewater.

[Objectives]

3. To understand the history, background and current situation of environmental pollution.
4. To understand the purification technology for organic pollution.
5. To understand the purification technology for nutrients (nitrogen and phosphorus) pollution.
6. To understand the purification technology for heavy metal pollution.
7. To understand the purification technology for persistent organic pollutants.
8. To understand the technology for energy/material recovery from wastes.
9. To understand the methodology for social implementation of environmental technology in Asia.

[Requirements]

It is desirable that you should have basic knowledge of chemistry, biology and environmental engineering.

[Evaluation]

2. Reports and/or short examination; evaluation point is theoretical consideration of environmental technology; 70%
3. Lecture attendance; evaluation point is active participation/attitude; 30%

[Textbooks]

[References]

[Schedule]

1. History, background and current situation of environmental pollution (Kazama, Mori, Toyama)
2. Purification technology for organic pollution: Source and type of pollution, current situation (Mori)
3. Purification technology for organic pollution: Basic of technology, leading-edge technology, future development (Mori)
4. Purification technology for nutrients (nitrogen and phosphorus) pollution: Source and type of pollution, current situation (Toyama)
5. Purification technology for nutrients (nitrogen and phosphorus) pollution: Basic of technology, leading-edge technology, future development (Toyama)
6. Purification technology for heavy metal pollution: Source and type of pollution, current situation (Kazama)
7. Purification technology for heavy metal pollution: Basic of technology, leading-edge technology, future development (Kazama)
8. Purification technology for persistent organic pollutants Source and type of pollution, current situation (Toyama)
9. Purification technology for persistent organic pollutants Basic of technology, leading-edge technology, future development (Toyama)
10. Technology for energy/material recovery from wastes: Basic of issue, current situation (Mori, Toyama)
11. Technology for energy/material recovery from wastes: Basic of technology, leading-edge technology, future development (Mori, Toyama)
12. Environmental treatment technology practice: Design, set-up and operation of reactor (Kazama, Mori, Toyama)
13. Environmental treatment technology practice: Chemical and biological analyses for reactor evaluation (Kazama, Mori, Toyama)
14. Methodology for social implementation of environmental technology in Asia: Extraction and identification of issue, discussion (Kazama, Mori, Toyama)
15. Methodology for social implementation of environmental technology in Asia: Presentation and discussion

(Kazama, Mori, Toyama)

[Title]			[Instructor]		
Advanced Environmental Data Analysis			Kei Nishida / Eiji Haramoto		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM706	2	Environmental and Social System Science Course	1st Semester	Fri.／I	English／Japanese

[Outline and purpose]

Basics of environmental measurements are learned to understand what the obtained information means. Basics of data processing are also learned by using monitoring results from a model basin. Japanese and oversea students study together through group work. English is potentially used.

[Objectives]

- Master the basics of experimental methods and how to finalize the data
- Master the basics of sorting monitoring data and estimate environmental loads
- Develop leadership, cooperativeness, and internationality

[Requirements]

Basic knowledge on water chemistry, microbiology, and hydrology is desirable.

[Evaluation]

Quiz and assignments: 50%
Attitude in the class: 25%
Presentation and discussion: 25%

[Textbooks]

Nothing special

[References]

Nothing special

[Schedule]

1. Introduction (Nishida, Haramoto)
2. Physicochemical analysis: outline of stable isotope analysis 1 (Nishida)
3. Physicochemical analysis: outline of stable isotope analysis 2 (Nishida)
4. Physicochemical analysis: stable isotope analysis for pollutants (Nishida)
5. Physicochemical analysis: standard curve and calibration (Nishida)
6. Physicochemical analysis: finalizing data (Nishida)
7. Physicochemical analysis: nutrient loading (Nishida)
8. Physicochemical analysis: presentation (Nishida)
9. Microbial analysis: outline of fecal indicator microorganisms (Haramoto)
10. Microbial analysis: measurement of fecal indicator microorganisms 1 (Haramoto)
11. Microbial analysis: measurement of fecal indicator microorganisms 2 (Haramoto)
12. Microbial analysis: measurement of fecal indicator microorganisms 3 (Haramoto)
13. Microbial analysis: data analysis 1 (Haramoto)
14. Microbial analysis: data analysis 2 (Haramoto)
15. Microbial analysis: presentation (Haramoto)

[Title]			[Instructor]		
Advanced Remote Sensing and Geographic Information System			Keiichi Masutani / Hiroshi Ishidaira / Jun Magome		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM707	2	Environmental and Social System Science Course	2nd Semester	Fri.／I	English／Japanese

[Outline and purpose]

This course provides basic theories and techniques to analyze environmental information, including remote sensing, GIS.
Japanese and oversea students study together through work group on some topics. English is potentially used.

[Objectives]

To understand the principles of remote sensing and GIS.
To understand the potential use of remote sensing and GIS on environmental analysis.

[Requirements]

Basic skills of computing.

[Evaluation]

1. Report: 20%
2. Attendance and Attitude: 50%
3. Summary report: 30%

[Textbooks]

Using original documents.

[References]

[Schedule]

1. Introduction
2. Basic concept of remote sensing
3. Basic theory of remote sensing
4. Exercise (1): handling of satellite images
5. Correction of satellite images
6. Exercise (2): geometric correction
7. Remote sensing for land
8. Exercise (3): normalized difference vegetation index (NDVI) and land-cover classification
9. Basic concept of GIS
10. Structure and preparation of GIS data
11. Exercise (4): visualization of GIS data
12. Spatial information analysis method
13. Exercise (5): spatial analyses with GIS
14. Exercise (6): spatial analyses with GIS
15. Summary

[Title]			[Instructor]		
Advanced Social Modeling and Simulation			Yoichi Shimazaki /Hiroshi Hirai		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN705	2	Environmental and Social System Science Course	2nd Semester	The.／V	Japanese

[Outline and purpose]

Students learn data analysis and simulation techniques in our class. These simulation results are very useful for suggesting new roles of the environmental and social system.

[Objectives]

To apply spatial analysis with geographical information system.
To apply energy data analysis and simulation.

[Requirements]

Basic skills of computing.

[Evaluation]

Report: 100%

[Textbooks]

None

[References]

None

[Schedule]

1. Introduction
2-8. Spatial analysis with geographical information system
9-15. Energy data analysis and simulation

[Title]			[Instructor]		
Environmental and Symbiotic Biology			Noboru Muramatu / Takao Miki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN706	2	Environmental and Social System Science Course	2nd Semester	Mon.／V	Japanese

[Outline and purpose]

The creature adapts to environment, and they have the mechanism that can adapt to an environmental change. We learn about the local weather and the mechanism for the molecular changes in the association with the plant or the microorganism and understand the survival strategy of the creature.

[Objectives]

To enable a learner to reach understand about a creature and symbiosis of nature from a macro and micro-viewpoint.

[Requirements]

Rudimentary knowledge of plant and microorganism are required.

[Evaluation]

Do a report on a creature and symbiosis.

[Textbooks]

[References]

[Schedule]

Part8-14: Response to temperature and other changes in micro-organism. Dr.MIKI
Part15: Summary

[Title]			[Instructor]		
Advanced Biology and Ecology			Taku Misonou / Junichi Miyazaki / Tomoya Iwata		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN707	2	Environmental and Social System Science Course	2nd Semester	Wed.／V	Japanese

[Outline and purpose]

This class provides information of modern biology and ecology to learn and to discuss the interaction between living organisms and their environment. The aim is to conserve endangered organisms and biodiversity and improvement of habitat environments and also to understand the behavior of human being and their society.

[Objectives]

1) To understand concept, theory, and mechanism of organisms and ecosystem
2) To understand how to study modern Biology/Ecology
3) To have a point of view from those disciplines on various scientific phenomena.

[Requirements]

Knowledge of basic biology and environment

[Evaluation]

Examination 50%
Report 50%

[Textbooks]

Handouts

[References]

[Schedule]

1. Guidance
2~8. What is Living Organism and Ecosystem
9~15. Interaction between Organisms and Environment

[Title]			[Instructor]		
Advanced Environmental Governance			Mikihiko Watanabe / Kiseong Kim		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN708	2	Environmental and Social System Science Course	2nd Semester	Thu.／II	Japanese

[Outline and purpose]

The objective of this course is to provide the students with a basic knowledge of "environmental governance" by which they can contribute a realization of the sustainable society. The students are, through this knowledge, expected to obtain trends of international environmental treaties and the situations of sustainable society. They are required to refer to selected references and to submit report(s) on these. Discussions with lecturer are required as well.

[Objectives]

1. To understand the main topics of environmental governance.
2. To be able to apply the theories of environmental governance to actually existing environmental problems.

[Requirements]

Basic knowledge of environmental politics and environmental economics.

[Evaluation]

Participation 50%
Final paper 50%

[Textbooks]

John Dryzek, *The Politics of the Earth*, Oxford: Oxford University Press, 2005.
Official Website of the United Nations Framework Convention on Climate Change https://www.unfccc.int/2860.php
Official Website of the Convention on Biological Diversity https://www.cbd.int/convention/

[References]

Students will be given a reading list in the beginning of the course.

[Schedule]

1. Introduction (Kim)
2. Sustainable development (Kim)
3. Ecological modernization (Kim)
4. Administrative rationalism (Kim)
5. Democratic pragmatism (Kim)
6. Economic rationalism (Kim)
7. Environmental policy integration (Kim)
8. Sustainable development strategy (Kim)
9. Environmental governance and the significance of the Convention on Biological Diversity (CBD) (Watanabe)
10. Ecosystem services, environmental values and sustainability (Watanabe)
11. Access and Benefit-Sharing (ABS) and the governance (Watanabe)
12. Traditional Knowledge (TK) and the governance (Watanabe)
13. The Nagoya Protocol and beyond (Watanabe)
14. Case 1: Inappropriate use of genetic resources (Watanabe)
15. Case 2: Traditional knowledge (Watanabe)