[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]		
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.