[Title]			[Instructor]		
Advanced Water Quality Assessment			Eiji Haramoto / Kei Nishida / Takashi Nakamura / Masaya Yasuhara / Nobuhito Ohte		
[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

[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 (Nishida, Haramoto, and Nakamura)
2 Outline of health-related items (Haramoto)
3 Outline and future of microbiological indicators (Haramoto)
4 Methods for microbial risk assessment (Haramoto)
5 Outline and future of living environmental items (Nishida)
6 Basics of health risk calculation (Nishida)
7 Basics of loading calculation (Nishida)
8 Basics of isotopic fractionation calculation (Ohte)
9 Examples of isotopic fractionation calculation (Ohte)
10 Outline of Environmental isotopes (Nakamura)
11 Environmental assessments by isoscape (Nakamura)
12 Examples and future of isotope monitoring (Yasuhara)
13 Future of isotope monitoring (Yasuhara)
14 Group discussion (Nishida, Haramoto, and Nakamura)
15 Presentation (Nishida, Haramoto, and Nakamura)

[Title]			[Instructor]		
Advanced Hydrology and Water Resources			Hiroshi Ishidaira / Kazuyoshi Souma / Keiichi Masutani		
[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 the elements of hydrology and water resources to understand the water cycle and river basin environments. The lecture starts by describing basic equations of fluid motion and water dynamics modeling through lectures and exercises. The lecture deals with not only the natural water cycle but also artificial control including reservoirs and irrigations. The lecture also deals with the current problems and prospects of water resources, including water environments and water usage. The lecture is mainly given in English.

[Objectives]

1. To be able to explain basic equations of fluid motion and their derivation (basic knowledge of Hydraulic Engineering).
2. To be able to explain elements of water dynamics model (basic knowledge of Hydraulic Engineering).
3. To be able to explain the current problems and prospects of water resources, including water environments and water usage (basic knowledge of Hydraulic Engineering).

[Requirements]

Basic knowledge on hydraulics, hydrology and calculus.

[Evaluation]

Report: 80%
Attendance and Attitude: 20%

[Textbooks]

[References]

[Schedule]

1. Introduction
2. Basic theory (physics) of material transport
3. Basic theory (physics) of water flow
4. Routing of channel flow
5. Evapotranspiration: Estimation methods
6. Evapotranspiration: Observation methods
7. Vertical movement of soil water
8. Ground water flow
9. Exercises about evapotranspiration and soil water movement
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			Tadashi Toyama / Tatsuru Kamei		
[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), microplastic, and persistent organic pollutants. In this lecture, we will learn the technologies for energy/material recovery from solid waste/wastewater.

[Objectives]

1. To understand the history, background, and current situation of environmental pollution.
2. To understand the purification technology for organic pollution.
3. To understand the purification technology for nutrients (nitrogen and phosphorus) pollution.
4. To understand the current situation of microplastic pollution and countermeasure.
5. To understand the purification technology for persistent organic pollutants.
6. To understand the technology for energy/material recovery from wastes.
7. To understand the decentralized water/wastewater technology.
8. To understand the methodology for SDGs achievement using environmental technology.

[Requirements]

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

[Evaluation]

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

[Textbooks]

[References]

[Schedule]

1. History, background, and current situation of environmental pollution (Toyama, Kamei)
2. Purification technology for nitrogen and phosphorus pollution: Source and type of pollution, current situation (Kamei)
3. Purification technology for nitrogen and phosphorus pollution: Leading-edge technology, future development (Kamei)
4. Decentralized water/wastewater treatment technology: Basic of technology for decentralized system (Kamei)
5. Decentralized water/wastewater treatment technology: Leading-edge technology, future development (Kamei)
6. Microplastic pollution: Source and type of pollution, current situation (Kamei)
7. Microplastic pollution: Countermeasure, future development (Kamei)
8. Purification technology for organic pollution: Source and type of pollution, current situation (Toyama)
9. Purification technology for organic pollution: Basic of technology, leading-edge technology, future development (Toyama)
10. Purification technology for persistent organic pollutants: Source and type of pollution, current situation (Toyama)
11. Purification technology for persistent organic pollutants: Basic of technology, leading-edge technology, future development (Toyama)
12. Technology for energy/material recovery from wastes: Basic of issue, current situation (Toyama)
13. Technology for energy/material recovery from wastes: Basic of technology, leading-edge technology, future development (Toyama)

14. Methodology for SDGs achievement using environmental technology: Presentation and discussion (Toyama)
15. Summary of Environmental Treatment Technology (Toyama, Kamei)

[Title]			[Instructor]		
Advanced River Basin Management			Shinichi Muto /Yutaka Ichikawa / Kazuyoshi Souma		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM705	2	Environmental and Social System Science Course	2nd Semester	Tue.／II	English／Japanese

[Outline and purpose]

In this lecture, students will learn the integrated river basin management and regional planning to solve the local water issues. This lecture deals with the management of floods / sediments within basin, water hazard risk estimation for disaster reduction, and environmental assessment / cost-benefit analysis for river basin environment and water resources. The lecture is mainly given in English.

[Objectives]

-To understand how to manage water quantity, quality, and environment within river basin (basic knowledge of Hydraulic Engineering).
-To understand how to evaluate water hazard risk (basic knowledge of Hydraulic Engineering).
-To understand how to carry out cost-benefit analysis for river basin management (basic knowledge of regional planning).

[Requirements]

Basic knowledge of environmental sciences (Hydrologic cycle, Hydrospheric Science), or engineering (Hydrology, Water Resources Engineering, River Engineering, Infrastructure Planning and Management).

[Evaluation]

Report: 70%
Attendance and Attitude: 30%

[Textbooks]

[References]

[Schedule]

1. Introduction
2. Concept of river basin management in Japan
3. Examples of river basin management in Japan
4. The way to make river management plan in Japan
5. Discussion for making river management plan: setting of objectives
6. Discussion for making river management plan: planning strategy
7. Sustainable river basin management to achieve SDGs
8. Flooding simulation for water hazard risk estimation: basic equations
9. Flooding simulation for water hazard risk estimation: numerical solutions
10. Flooding simulation for water hazard risk estimation: practices
11. Applications of water hazard risk estimation
12. Cost-benefit analysis for river basin management
13. Cost-benefit analysis based on economic equilibrium models
14. Practice of cost-benefit analysis for river basin management
15. Presentations of cost-benefit analysis for river basin management

[Title]			[Instructor]		
Advanced Environmental Data Analysis			Eiji Haramoto / Kei Nishida / Takashi Nakamura / Tadashi Toyama / Tatsuru Kamei		
[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]

The purpose of this class is to understand the basics of environmental statistics which is essential in environmental science researches. This class contains a variety of topics, such as basic statistics, probability distribution, analysis of variance, regression analysis, and multivariate analysis. Japanese and oversea students study together through group work. English is potentially used.

[Objectives]

- To be able to explain theoretically about the results of statistical analysis for environmental datasets using appropriate statistical method(s).

[Requirements]

Basic knowledge on statistics and water quality 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, Toyama, Nakamura, and Kamei)
2. Basic statistics: arithmetic/geometric mean, variance, and standard deviation (Haramoto)
3. Basic statistics: moving average and correlation coefficient (Haramoto)
4. Basic statistics: Spearman's rank correlation coefficient (Haramoto)
5. Probability distribution and analysis of variance: probability distribution (Nishida)
6. Probability distribution and analysis of variance: Monte Carlo simulation (Nishida)
7. Probability distribution and analysis of variance: t-test and analysis of variance (Nishida)
8. Regression analysis: simple regression analysis and least-squares method (Nakamura)
9. Regression analysis: correlation coefficient and coefficient of determination (Nakamura)
10. Regression analysis: multiple regression analysis (Nakamura)
11. Multivariate analysis: cluster analysis (Toyama)
12. Multivariate analysis: multivariate analysis and : principal component analysis (Toyama)
13. Practice for statistics analysis-1 (Kamei)
14. Practice for statistics analysis-1 (Kamei)
15. Summary of the class (Nishida, Haramoto, Toyama, Nakamura, and Kamei)

[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 Research Exercises for River Basin Environmental SDGs			Supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM708	1	Environmental and Social System Science Course	Intensive	／	English／Japanese

[Outline and purpose]

The goal is to acquire the skills and know-how necessary to carry out research through the formulation of research plans, preparation of basic documents such as proposals and research progress reports, and discussions with a group of academic advisors. The program also aims to help students acquire high communication skills through joint presentations, discussions, and group work with the entire student body of the interdisciplinary program.

[Objectives]

1) Briefly can be explain about the own research
2) To be able to get to the point and communicate concisely
3) Ability to structure documents and give oral explanations in a logical manner

[Requirements]

Review and discussion of relevant academic papers and social conditions parties

[Evaluation]

Report 50%: Logic of description and explanation
Attitude 20%: Proactivity in speaking and facilitating
Presentation 30%: Concise raws of presentation

[Textbooks]

Nothing special

[References]

Nothing special

[Schedule]

1) Closed discussion with a group of supervisors 2 times/semester
2) Program student presentations, discussions and group work 3 times/semester

[Title]			[Instructor]		
Advanced Internship for River Basin Environmental SDGs			Supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTM709	1	Environmental and Social System Science Course	Intensive	／	English／Japanese

[Outline and purpose]

Internships and fieldwork will be conducted in the target regions of Asia and Africa, with the goal of acquiring knowledge, skills, and training management (planning and negotiation) abilities that will contribute to solving problems occurring in the field. The program also aims to provide students with the practical experience necessary to become internationally active public servants and professionals.

[Objectives]

・To be able to develop their own specialized research from the perspective of the SDGs as well through off-campus training.
・To be able to express ideas about the connection between research and society.
・To be able to think inclusively in consideration of international social conditions.

[Requirements]

・Secure training and fieldwork hosts
・Drafting a plan and coordinating with the supervisors

[Evaluation]

Report 50%: Mission accomplishment
Presentation 50%: Mission accomplishment

[Textbooks]

Nothing special

[References]

Nothing special

[Schedule]

1) Planning of internship and negotiation with local hosts
2) Training at internship site
3) Presentation and discussion of results in the program