

[Title]			[Instructor]		
Environmental Statistics			Kei Nishida / Eiji Haramoto / Takashi Nakamura / Tadashi Toyama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR510	2	Civil and Environmental Engineering	1st Semester	Fri./I	Japanese English
[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 overseas 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]					
<ol style="list-style-type: none"> <li>1. Introduction (Nishida, Haramoto, Toyama, Nakamura)</li> <li>2. Basic statistics: arithmetic/geometric mean, variance, and standard deviation (Haramoto)</li> <li>3. Basic statistics: moving average and correlation coefficient (Haramoto)</li> <li>4. Basic statistics: Spearman's rank correlation coefficient (Haramoto)</li> <li>5. Basic statistics: practice (Haramoto)</li> <li>6. Probability distribution and analysis of variance: probability distribution and Monte Carlo simulation (Nishida)</li> <li>7. Probability distribution and analysis of variance: t-test and analysis of variance (Nishida)</li> <li>8. Probability distribution and analysis of variance: practice (Nishida)</li> <li>9. Regression analysis: simple regression analysis, least-squares method, correlation coefficient, and coefficient of determination (Nakamura)</li> <li>10. Regression analysis: multiple regression analysis (Nakamura)</li> <li>11. Regression analysis: practice (Nakamura)</li> <li>12. Multivariate analysis: cluster analysis (Toyama)</li> <li>13. Multivariate analysis: multivariate analysis and : principal component analysis (Toyama)</li> <li>14. Multivariate analysis: practice (Toyama)</li> <li>15. Summary of the class (Nishida, Haramoto, Toyama, Nakamura)</li> </ol> <p>* This class will be generally provided using Zoom but some lectures may be provided via face-to-face.</p>					

[Title]			[Instructor]		
Life and Health			Eiji Haramoto / Kei Nishida / Naoki Kondo / Zentarō Yamagata / Atsuhito Nakao / Masaaki Kitajima		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR512	2	Civil and Environmental Engineering	Intensive	/	Japanese English
[Outline and purpose]					
<p>This class is designed to provide you with a basic knowledge on the assessment of population health and health risks in the environmental context of river basins in developing countries, and its application to actual environmental interventions. The primary methodology you learn in this course is from epidemiology but this course also covers a variety of disciplines including environmental engineering, immunology, microbiology, and public health policy. You learn about the hazardous factors in physical and social environment and their potential adverse impacts on health, and the methods for the identification and quantification of those health risks. We wrap up the course with the discussion on how to apply the scientific evidence to the real world, introducing some examples such as the Health Impact Assessment framework and some interdisciplinary approaches to the management of environment and population health.</p>					
[Objectives]					
<ul style="list-style-type: none"> <li>- Environmental engineering: To understand the basics on environmental hazards.</li> <li>- Health risk: To understand the basics on health risk analysis.</li> <li>- Immunology: To understand the basics of human immunology and the immunological responses to the pathogenic substances in the water.</li> <li>- Epidemiology: To understand the basic epidemiologic designs, index on population health and health risks, the concept of bias and confounding, and basics in biostatistics.</li> <li>- Public health: To understand the basics on health impact assessment.</li> <li>- Wastewater-based epidemiology: To understand the basics of Wastewater-based epidemiology.</li> </ul>					
[Requirements]					
Chemistry, biology, statistic, and mathematics at university basic course level.					
[Evaluation]					
Quiz and assignments: 50% Attitude in the class: 50%					
[Textbooks]					
Nothing special					
[References]					
Nothing special					
[Schedule]					

1. Environmental Engineering 1 (Haramoto)
2. Environmental Engineering 2 (Haramoto)
3. Environmental Engineering 3 (Haramoto)
4. Health Risk 1 (Nishida)
5. Health Risk 2 (Nishida)
6. Immunology 1 (Nakao)
7. Immunology 2 (Nakao)
8. Epidemiology 1 (Yamagata)
9. Epidemiology 2 (Yamagata)
10. Public health 1 (Kondo)
11. Public health 2 (Kondo)
12. Public health 3 (Kondo)
13. Wastewater-based epidemiology 1 (Kitajima)
14. Wastewater-based epidemiology 2 (Kitajima)
15. Wastewater-based epidemiology 3 (Kitajima)

\* This class will be generally provided using Zoom but some lectures may be provided via face-to-face.

[Title]			[Instructor]		
River Basin Planning and Design			Shinichi Muto/Yutaka Ichikawa/ Kazuyoshi Souma		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR513	2	Civil and Environmental Engineering	2nd Semester	Tue./II	Japanese English
[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]					
<ul style="list-style-type: none"> <li>-To understand how to manage water quantity, quality, and environment within river basin.</li> <li>-To understand how to evaluate water hazard risk</li> <li>-To understand how to carry out cost-benefit analysis for river basin management</li> </ul>					
[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]					
<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Concept of river basin management in Japan</li> <li>3. Examples of river basin management in Japan</li> <li>4. The way to make river management plan in Japan</li> <li>5. Discussion for making river management plan: setting of objectives</li> <li>6. Discussion for making river management plan: planning strategy</li> <li>7. Sustainable river basin management to achieve SDGs</li> <li>8. Flooding simulation for water hazard risk estimation: basic equations</li> <li>9. Flooding simulation for water hazard risk estimation: numerical solutions</li> <li>10. Flooding simulation for water hazard risk estimation: practices</li> <li>11. Applications of water hazard risk estimation</li> <li>12. Cost-benefit analysis for river basin management</li> <li>13. Cost-benefit analysis based on economic equilibrium models</li> <li>14. Practice of cost-benefit analysis for river basin management</li> <li>15. Presentations of cost-benefit analysis for river basin management</li> </ol>					

[Title]			[Instructor]		
Advanced Hydrology and Water Resources			Hiroshi Ishidaira / Kazuyoshi Souma /Keiichi Masutani		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR506	2	Civil and Environmental Engineering Special Educational Program on River Basin Environmental Science	1st Semester	Thu./II	Japanese/ English
[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]					
<ol style="list-style-type: none"> <li>1. To understand basic equations of fluid motion and their derivation.</li> <li>2. To understand 1-dimensional open channel flow equations and their derivation.</li> <li>3. To understand kinematic wave model equations and their derivation.</li> <li>4. To understand storage type water dynamics model and their derivation.</li> <li>5. To understand basic of numerical solution technique for water flow models.</li> </ol>					
[Requirements]					
Basic knowledge on hydraulics, hydrology and calculus.					
[Evaluation]					
Report: 40% Final exam: 40% Attendance and Attitude: 20%					
[Textbooks]					
[References]					
[Schedule]					
<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Basic equations of fluid motion</li> <li>3. Basic equations of material transport</li> <li>4. Runoff process and water quality</li> <li>5. Vertical movement of soil water and solute transport</li> <li>6. Groundwater flow and solute transport</li> <li>7. River flow process</li> <li>8. Evapotranspiration: theory</li> <li>9. Evapotranspiration: model</li> <li>10. River basin hydrological model: conceptual model and lumped model</li> <li>11. River basin hydrological model: distributed model</li> <li>12. Modeling of water use and water control</li> <li>13. Water resources in Japan</li> <li>14. Water resources in the world</li> <li>15. Summary</li> </ol>					

[Title]			[Instructor]		
Advanced Water Environment Assessment			Eiji Haramoto / Kei Nishida / Takashi Nakamura / Futaba Kazama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR507	2	Civil and Environmental Engineering	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]					
<ul style="list-style-type: none"> <li>- Understanding basic concept of water quality control and calculation of guideline values</li> <li>- Understanding basic concept of water quality modelling and capable of introducing the equations</li> </ul>					
[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 of microbiological indicators (Haramoto) 4 Methods for microbial risk assessment (Haramoto) 5 Future of microbiological indicators (Haramoto) 6 Outline and future of living environmental items (Nishida) 7 Basics of health risk calculation (Nishida) 8 Basics of loading calculation (Nishida) 9 Basics of isotopic fractionation calculation (Nishida) 10 Outline of Environmental isotopes (Nakamura) 11 Examples and future of isotope monitoring (Nakamura) 12 Environmental assessments by isoscape (Nakamura) 13 Outline of governmental procedures for setting water quality standards (Kazama) 14 Examples of governmental procedures for setting water quality standards (Kazama) 15 Management of water quality and activities of citizens (Kazama) * This class will be generally provided using Zoom but some lectures may be provided via face-to-face.					

[Title]			[Instructor]		
Advanced Environmental Treatment Technology			Futaba Kazama / Kazuhiro Mori / Tadashi Toyama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR508	2	Civil and Environmental Engineering Special Educational Program on River Basin Environmental Science	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]					
<ol style="list-style-type: none"> <li>To understand the history, background and current situation of environmental pollution.</li> <li>To understand the purification technology for organic pollution.</li> <li>To understand the purification technology for nutrients (nitrogen and phosphorus) pollution.</li> <li>To understand the purification technology for heavy metal pollution.</li> <li>To understand the purification technology for persistent organic pollutants.</li> <li>To understand the technology for energy/material recovery from wastes.</li> <li>To understand the methodology for social implementation of environmental technology in Asia.</li> </ol>					
[Requirements]					
It is desirable that you should have basic knowledge of chemistry, biology and environmental engineering.					
[Evaluation]					
<ol style="list-style-type: none"> <li>Reports and/or short examination; evaluation point is theoretical consideration of environmental technology; 70%</li> <li>Lecture attendance; evaluation point is active participation/attitude; 30%</li> </ol>					
[Textbooks]					
[References]					
[Schedule]					
<ol style="list-style-type: none"> <li>History, background and current situation of environmental pollution (Kazama, Mori, Toyama)</li> <li>Purification technology for organic pollution: Source and type of pollution, current situation (Mori)</li> <li>Purification technology for organic pollution: Basic of technology, leading-edge technology, future development (Mori)</li> <li>Purification technology for nutrients (nitrogen and phosphorus) pollution: Source and type of pollution, current situation (Toyama)</li> <li>Purification technology for nutrients (nitrogen and phosphorus) pollution: Basic of technology, leading-edge technology, future development (Toyama)</li> <li>Purification technology for heavy metal pollution: Source and type of pollution, current situation (Kazama)</li> <li>Purification technology for heavy metal pollution: Basic of technology, leading-edge technology, future development (Kazama)</li> <li>Purification technology for persistent organic pollutants Source and type of pollution, current situation (Toyama)</li> <li>Purification technology for persistent organic pollutants Basic of technology, leading-edge technology, future development (Toyama)</li> <li>Technology for energy/material recovery from wastes: Basic of issue, current situation (Mori, Toyama)</li> <li>Technology for energy/material recovery from wastes: Basic of technology, leading-edge technology, future development (Mori, Toyama)</li> <li>Environmental treatment technology practice: Design, set-up and operation of reactor (Kazama, Mori, Toyama)</li> <li>Environmental treatment technology practice: Chemical and biological analyses for reactor evaluation (Kazama, Mori, Toyama)</li> <li>Methodology for social implementation of environmental technology in Asia: Extraction and identification of issue, discussion (Kazama, Mori, Toyama)</li> <li>Methodology for social implementation of environmental technology in Asia: Presentation and discussion</li> </ol>					

(Kazama, Mori, Toyama)



[Title]			[Instructor]		
Seminar in River Basin Environmental Science IA			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR601	1	Special Educational Program on River Basin Environmental Science	1st Semester	Mon./V	Japanese/English
[Outline and purpose]					
The purpose of this practice is to secure necessary basic knowledge and technique for research. Survey, experiment and analysis concerning research subject et al. are conducted under the guidance of a group of academic supervisors. And presentation and discussion are conducted. Student must belong to a seminar group (Hydrology and hydraulic, water quality, microbiology) composed of graduate students, researchers and teachers and it's better to attend other seminar.					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Reviewing lecture relating research at undergraduate course					
[Evaluation]					
Integrated evaluation including interim presentation : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Seminar in River Basin Environmental Science IB			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR602	1	Special Educational Program on River Basin Environmental Science	2nd Semester	Mon./V	Japanese/English
[Outline and purpose]					
The purpose of this practice is to secure necessary basic knowledge and technique for research. Survey, experiment and analysis concerning research subject et al. are conducted under the guidance of a group of academic supervisors. And presentation and discussion are conducted. Student must belong to a seminar group (Hydrology and hydraulic, water quality, microbiology) composed of graduate students, researchers and teachers and it's better to attend other seminar.					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Reviewing lecture relating research at undergraduate course					
[Evaluation]					
Integrated evaluation including interim presentation : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Seminar in River Basin Environmental Science IIA			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR603	1	Special Educational Program on River Basin Environmental Science	1st Semester	Fri./V	Japanese/English
[Outline and purpose]					
The purpose of this practice is to secure necessary advanced knowledge and technique for research. Survey, experiment and analysis concerning research subject et al. are conducted under the guidance of a group of academic supervisors. And presentation and discussion are conducted. Student must belong to a seminar group (Hydrology and hydraulic, water quality, microbiology) composed of graduate students, researchers and teachers and it's better to attend other seminar.					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Reviewing lecture relating research at undergraduate course					
[Evaluation]					
Integrated evaluation including interim presentation : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Seminar in River Basin Environmental Science IIB			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR604	1	Special Educational Program on River Basin Environmental Science	2nd Semester	Fri./V	Japanese/English
[Outline and purpose]					
<p>The purpose of this practice is to secure necessary advanced knowledge and technique for research. Survey, experiment and analysis concerning research subject et al. are conducted under the guidance of academic supervisor and a group of academic supervisors. And presentation and discussion are conducted. Student must belong to a seminar group (Hydrology and hydraulic, water quality, microbiology) composed of graduate students, researchers and teachers and it's better to attend other seminar.</p>					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Reviewing lecture relating research at undergraduate course					
[Evaluation]					
Integrated evaluation including interim presentation : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Research Work in River Basin Environmental Science IA			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR605	2	Special Educational Program on River Basin Environmental Science	1st Semester		Japanese/ English
[Outline and purpose]					
Student carry out research activity such as investigation of research background according to research style under the guidance of a group of academic supervisors about each research subject selected					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Various knowledge relating research					
[Evaluation]					
Integrated evaluation including attitude at seminar : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Research Work in River Basin Environmental Science IB			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR606	2	Special Educational Program on River Basin Environmental Science	2nd Semester		Japanese/ English
[Outline and purpose]					
Student carry out research activity such as investigation of research background according to research style under the guidance of a group of academic supervisors about each research subject selected					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Various knowledge relating research					
[Evaluation]					
Integrated evaluation including attitude at seminar : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Research Work in River Basin Environmental Science IIA			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR607	2	Special Educational Program on River Basin Environmental Science	1st Semester		Japanese/ English
[Outline and purpose]					
Student carry out research activity such as investigation of research background according to research style under the guidance of a group of academic supervisors about to each research subject selected					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Various knowledge relating research					
[Evaluation]					
Integrated evaluation including interim presentation : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					

[Title]			[Instructor]		
Research Work in River Basin Environmental Science IIB			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTR608	2	Special Educational Program on River Basin Environmental Science	2nd Semester		Japanese/ English
[Outline and purpose]					
Student carry out research activity such as investigation of research background according to research style under the guidance of a group of academic supervisors about to each research subject selected					
[Objectives]					
Ultimate target that a group of academic supervisors decided					
[Requirements]					
Various knowledge relating research					
[Evaluation]					
Integrated evaluation including presentation of research result at master course : 100%					
[Textbooks]					
Textbooks that a group of academic supervisors designates					
[References]					
References that a group of academic supervisors designates					
[Schedule]					
Contents that a group of academic supervisors designates					