[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 / Kazuaki Ohtsuki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTL701	2	Environmental and Social System Science Course	2nd Semester	Fri.／III	Japanese

[Outline and purpose]

The purpose of this lecture is to study the management method of disaster prevention and mitigation, targeting earthquake, flood disaster etc. In the lecture, facts of disaster, issues 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 management and 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)
・鈴木猛康編著：防災工学、理工図書（ISBN:978-4-8446-0879-0） (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
・Legal systems for disaster management
・Facts of disasters
・Watershed management
・Regional disaster management and application of ICT
・Disaster prevention and mitigation
・Issues of countermeasures against disasters

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]		
Infrastructure Maintenance Management			Shigehiko Saito / Shinichi Muto		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTL705	2	Environmental and Social System Science Course	2nd Semester	Fri.／I	Japanese English

[Outline and purpose]

We will study the concept of maintenance system for structures consisting social infrastructure stocks to develop sustainable social infrastructure. This course provides system and method of asset management including predicting life-cycle costs, its minimization, and financial measures. We will perform stock management simulation of social infrastructures for a virtual local government.

[Objectives]

- to explain effective maintenance system for social infrastructures
- to explain stock management of social infrastructures

[Requirements]

1. a fundamental knowledge for design and construction of infrastructures.
2. a fundamental knowledge for urban planning and statistics.

[Evaluation]

Report on infrastructure management: 80%
Discussion on the curse contents: 20%

[Textbooks]

[References]

[Schedule]

I. maintenance of infrastructures (Prof. Saito)
1. basic concept of maintenance of infrastructures
2. conducting maintenance plans
3. investigations of infrastructures
4. assessment of infrastructures
5. effective remedial measures of infrastructures
6. recording of maintenance works
7. developing reasonable maintenance system

II. stock management of infrastructures (Assoc. Prof. Muto)
8. basic concept of management of infrastructure
9. economic impact of management of infrastructure
10. estimating life cycle cost of infrastructure
11. minimizing life cycle costs of infrastructure
12. methods of management of infrastructure
13. efficient method of management of infrastructure
14. proposing effective management of infrastructure
15. comprehensive evaluation

[Title]			[Instructor]		
Advanced Water Quality Assessment			Eiji Haramoto / Kei Nishida / Takashi Nakamura / Futaba Kazama		
[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 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 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	1nd 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]

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 purification technology for heavy metal pollution.
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 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]

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 (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 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.
-To understand how to evaluate water hazard risk
-To understand how to carry out cost-benefit analysis for river basin management

[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			Kei Nishida / Eiji Haramoto / Takashi Nakamura / Tadashi Toyama		
[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)
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. Basic statistics: practice (Haramoto)
6. Probability distribution and analysis of variance: probability distribution and Monte Carlo simulation (Nishida)
7. Probability distribution and analysis of variance: t-test and analysis of variance (Nishida)
8. Probability distribution and analysis of variance: practice (Nishida)
9. Regression analysis: simple regression analysis, least-squares method, correlation coefficient, and coefficient of determination (Nakamura)
10. Regression analysis: multiple regression analysis (Nakamura)
11. Regression analysis: practice (Nakamura)
12. Multivariate analysis: cluster analysis (Toyama)
13. Multivariate analysis: multivariate analysis and : principal component analysis (Toyama)
14. Multivariate analysis: practice (Toyama)
15. Summary of the class (Nishida, Haramoto, Toyama, Nakamura)

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

[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 Environmental and Mathematical Sciences			Kazuho Ito		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN702	2	Environmental and Social System Science Course	1nd Semester	Thu.／II	Japanese

[Outline and purpose]

Some system like the nature or the human societies behaves as a dynamic system. By extracting characteristic features of the systems, environmental modeling and programing are carried out. Computer simulations are employed to predict and evaluate the systems which change as time elapses.

[Objectives]

To be able to describe some natural phenomena as mathematical models by partial differential equations.
To be able to construct numerical schemes for solving model equations, and to implement them as computer programs.

[Requirements]

Some knowledge of calculus, linear algebra and differential equations are assumed.

[Evaluation]

Project related to modeling and numerical simulation.

[Textbooks]

[References]

[Schedule]

1—5. Mathematical modeling for some natural phenomena with partial differential equations.

6—10. Difference and spectral method for discretizing partial differential equations.

11—15. Matlab programing for solving model equations.

[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			Junichi Miyazaki / Tomoya Iwata / Yukihiko Serisawa		
[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.／I	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)

[Title]			[Instructor]		
Interdisciplinary Physics			Hiroyuki Shima		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
PTN711	2	Environmental and Social System Science Course	1nd Semester	Fri./IV	Japanese

[Outline and purpose]

To acquire an interdisciplinary perspective that spans chemistry, biology, earth science, and astronomy, centered on physics-based thinking methods.

[Objectives]

To become able to explain the close relationship between physics and non-physics fields (especially evolutionary biology), to describe mathematical formulas that express the basic laws of physics, and to explain their physical meaning.

[Requirements]

Basic knowledge of undergraduate degree in physics, chemistry, and biology.

[Evaluation]

With several mini-exams and reports.

[Textbooks]

n/a

[References]

n/a

[Schedule]

1. Introduction to the entire lecture

2. Crowd behavior of living things
keywords: active matter, allometry

3. Insects' internal mechanism
keywords: light diffraction, aerodynamics, structural strength, thermal inertia

4. Building the bodies of aquatic and terrestrial animals
keywords: gravity, gait, water resistance, Darwinian evolution

5. Cellular and microbial physics
keywords: amphipathic molecules, viscosity, fluid dynamics, energy generation

6. Organisms living in extreme environments
keywords: thermophiles, environmental radiation, osmotic pressure, water activity

7. DNA and RNA physics

keywords: hydrogen bonds, folding structures of protein molecules, topology

8. Cell energy collection function
keywords: electron transport chain, methanogen, habitable zone

9. Water physics
keywords: ice planet, water physiology, hydrolysis

10. Atoms that control life
keywords: electron orbit, Pauli exclusion principle, interstellar medium, sea of ammonia

11. Integration of physics and biology 1
keywords: universal biology, astrobiology

12. Integration of physics and biology 2
keywords: quantum theory, uncertainty, reductionism

13. Space Development Science and Technology 1
keywords: space elevator, exoplanet exploration

14. Space Development Science and Technology 2
keywords: space debris, lunar resources, water on Mars

15. Overall summary