[Title]				[Instructor]		
Advanced Sustainable Society Studies				Satoshi Takeuchi		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328110	2	Sustainable Society Studies		1st Semester	Mon.／I	English／ Japanese

[Outline and purpose]

In this course, students will be expected to understand ecosocial system and sustainable society and to be able to explain the essences of environmental issues at local, national and global levels.

[Objectives]

1. To understand ecological system and sustainable society

[Requirements]

Fundamental knowledge on science and technology, culture, society.
Fundamental knowledge on Linear algebra and Differential equations.

[Evaluation]

Participation: 50%
Homework and Report: 50%

[Textbooks]

Distribution of material on topics

[References]

M.L. Deaton & J.J. Winebrake：Dynamic Modeling of Environmental Systems, Springer-Verlag, New York, 2000.
高橋哲哉、山影進　編、人間の安全保障、東京大学出版会、2008 年。

[Schedule]

1. Introduction: from ecosocial society to sustainable society
2. The earth in the universe
3. Think about global environments from the Antarctic
4. Material circulation
5. Report I
6. Global warming skepticism and Information
7. Computer simulation of global warming I
8. Computer simulation of global warming II
9. Computer simulation of population and resource system
10. Report II
11. Renewable energy and its economic efficiency
12. Linear Chuo Shinkansen and its economic policy
13. Nuclear disasters and energy policy
14. Environmental issues relating to human security
15. Report III

[Title]					[Instructor]		
Regional Management and Consensus Building					Susumu Kitagawa / Keiji Kadono / Kiseong Kim / Tomoko Takahashi		
[Code]	[Credits]	[Program]			[Semester]	[Hours]	[Language of instruction]
328115	2	Sustainable Society Studies			1st Semester	Thu.／I	Japanese

[Outline and purpose]

This is the course on sustainable society that focuses on consensus building.
First, the course explores current perspectives and techniques in the analysis of sustainable society, then independent producing and management.

[Objectives]

To be able to explain the significance of consensus building and management which include politics; government; public finance; scientific technology; urban planning; business; local government; local organization.

[Requirements]

To secure the enough expert knowledge to present at outside conference and carry out the joint activity such as social science and political science.

[Evaluation]

Attendance:30%
Report and Presentation:70%

[Textbooks]

Books are introduced in the lecture.

[References]

Books are introduced in the lecture.

[Schedule]

1. Introduction of works.
2-6. lecture of consensus building in various fields.
9-13. field work and individual tutoring
14-15. Analytical final report, presentation and group discussion, and summarization.

[Title]				[Instructor]		
Information Technologies for Environmental Studies				Kazuho Ito / Tomoya Iwata		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328125	2	Sustainable Society Studies		1st Semester	Mon.／II	Japanese

[Outline and purpose]

This course provides lectures and exercises of the computing environments, such as Matlab and geographical information system (GIS), for performing the data analyses of natural and social environments. Topics include: (i) Numerical analyses and data visualization with Matlab. (ii) Geographical analyses of spatial data with GIS.

[Objectives]

1. to acquire the basic ability to use Matlab and GIS software.
2. to solve the exercises about environmental sciences by using Matlab and GIS software.

[Requirements]

Basic groundings in Computer science and Mathematics (e.g., linear algebra and calculus).

[Evaluation]

1. Report: 80%
2. Attendance and Attitude: 20%

[Textbooks]

No designated textbook.

[References]

[Schedule]

1. A Brief Tutorial of MATLAB (1)
2. A Brief Tutorial of MATLAB (2)
3. Matrices in MATLAB
4. Exercises for principal component analysis with MATLAB (1)
5. Exercises for principal component analysis with MATLAB (2)
6. MATLAB programing (1)
7. MATLAB programing (2)
8. Introduction of GIS
9. Making spatial maps with GIS (1)
10. Making spatial maps with GIS (2)
11. Spatial analyses with GIS (1)
12. Spatial analyses with GIS (2)
13. Application of GIS to environmental problems (1)
14. Application of GIS to environmental problems (2)
15. Summary of Information Technologies for Environmental Studies

[Title]				[Instructor]		
Public Policy				Keiji Kadono		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328135	2	Sustainable Society Studies		1st Semester	Fri./II	English／Japanese

[Outline and purpose]

This is the course on public policy analysis that focuses on sustainable region.
The course explores current perspectives and techniques in the analysis of sustainable region.

[Objectives]

To be able to explain the significance of policy-making process, and structure to the determination of result.

[Requirements]

To secure the enough expert knowledge to present at outside conference and carry out the joint activity

[Evaluation]

Attendance:10%
Report and Presentation:90%

[Textbooks]

Books are introduced in the lecture

[References]

Books are introduced in the lecture.

[Schedule]

1. Introduction of textbook and works.
2-14. Analytical report, presentation and group discussion. Required readings.
15. Final discussion.

[Title]				[Instructor]		
Issues in Environmental Politics				Kiseong Kim		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328210	2	Sustainable Society Studies		1st Semester	Mon./II	Japanese

[Outline and purpose]

The goal of this course is to foster a basic knowledge of different environmental discourses and their implications on environmental policy and politics. Students will be expected to understand the similarities and differences between different environmental discourses and to be able to apply them to explain the politics of the environment. This course also provides an introduction to environmental issues at local, national and global levels.

[Objectives]

1. To understand the basic storylines and their political implication of the main environmental discourses.
2. To foster a basic knowledge of environmental policy and politics.

[Requirements]

1. Attendance is not optional.
2. Students are expected to read all reading assignments.
3. Students should make a term paper presentation at the end of the semester.

[Evaluation]

1. Participation: 50%
2. Term paper: 50%

[Textbooks]

John S. Dryzek, *The politics of the Earth : Environmental Discourses*, Second Edition, Oxford: Oxford University, 2005. (『地球の政治学』, 風行社, 2007)

[References]

John S. Dryzek and David Schlosberg, *Debating the Earth: The Environmental Politics Reader* (Second Edition), Oxford: Oxford University Press, 2004.
Miranda A. Schreurs, *Environmental Politics in Japan, Germany, and the United States,* Cambridge: Cambridge University Press, 2002. (『地球環境問題の比較政治学』, 岩波書店, 2007)

[Schedule]

1. Introduction
2. Industrialism
3. Limits to growth
4. Environmental skepticism
5. Administrative rationalism
6. Democratic pragmatism
7. Economic rationalism
8. Sustainable development
9. Ecological modernization
10. Environmental policy integration
11. National sustainable development strategy
12. Green politics
13. Ecological democracy
14. International environmental regimes
15. Term paper presentation

[Title]				[Instructor]		
Advanced Energy Policy				Yoichi Shimazaki		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328290	2	Sustainable Society Studies		2nd Semester	Tue.／III	Japanese

[Outline and purpose]

Our life and economic activities are based on the consumption of energy resources. It is important to study what the sustainable society should be like by taking into consideration matters relating to the energy policy, including energy production, distribution and consumption.

[Objectives]

To understand the current energy policy.
To understand the energy data analysis.

[Requirements]

Basic spreadsheet skills.

[Evaluation]

Report: 50%
Attendance and attitude: 30%
Presentation: 20%

[Textbooks]

Agency for Natural Resources and Energy (2010) Energy in Japan 2010

[References]

International Energy Agency, http://www.iea.org/

[Schedule]

1. Introduction
2. World energy outlook
3. Energy situation in Japan
4. Regional energy system
5. Energy resource
6. Renewable energy
7. Energy conservation
8. Energy management
9. Energy and environmental education
10. Energy data analysis 1
11. Energy data analysis 2
12. Presentation 1
13. Presentation 2
14. Presentation 3
15. Summary

[Title]				[Instructor]		
Advanced Course of Applied Science for Renewable Energy Conversion				Masaharu Komiyama		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328300	2	Sustainable Society Studies		2nd Semester	Fri./IV	English/ Japanese

[Outline and purpose]

　The first half of this lecture overviews the status quo of renewable energies such as solar, wind, biomass, wave, ocean thermal and their conversion technologies, and examine their road map into the future.　In the latter half is focused on biomass energy, and the details of its potential and its energy conversion technologies are examined.

[Objectives]

1) Understand the status quo of the renewable energy conversion technologies and their potential in the near future.
2) Understand technological details of biomass energy conversion and their application to bio-refinery.

[Requirements]

　Knowledge on chemistry and physics at undergraduate level.　Basic understanding of chemical thermodynamics.

[Evaluation]

Examination: midterm 50%, final 50%.

[Textbooks]

[References]

1. NEDO White Book on Renewable Energy Technology (in Japanese)
   (Downloadable from http://www.nedo.go.jp/library/ne_hakusyo_index.html)
2. 清水幸丸, 再生型自然エネルギー利用技術, パワー社, ISBN:978-4-8277-2267-3
3. 横山伸也、芋生憲司, バイオマスエネルギー, 森北出版, ISBN:978-4-627-94721-4
4. 木谷収, バイオマスー生物資源と環境ー, コロナ社, ISBN:978-4-339-06733-0

[Schedule]

1st - 7th week: The status quo of renewable energy (solar, wind, biomass, wave, ocean thermal, etc.) conversion technologies and their road map.
8th – 11th week: Potential of biomass energy and its energy conversion technologies.
12th – 15th week: Bio-refinery technologies and their applications.

[Title]				[Instructor]		
Remote Sensing for Environmental Analysis				Hiroshi Kobayashi		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328315	2	Sustainable Society Studies		2nd Semester	Mon./IV	Japanese

[Outline and purpose]

This course provides an introduction to theories, methods, and algorithms of remote sensing and their applications of environmental analysis.

[Objectives]

To understand the principles of remote sensing.
To understand the radiative transfer theory.

[Requirements]

Basic groundings in Electromagnetics and Calculus.
Basic skills of UNIX.

[Evaluation]

1. Report: 50%
2. Attendance and Attitude: 50%

[Textbooks]

No designated textbook.

[References]

浅野正二, 大気放射学の基礎, 朝倉出版, ISBN:978-4-254-161122-9 (in Japanese)

[Schedule]

1. Introduction
2. Principles of radiation
3. Radiative properties of the earth
4. Absorption bands of atmospheric gases
5. Absorption and scattering processes by aerosols
6. Radiative transfer of solar radiation in a scattering atmosphere
7. Remote sensing for land
8. Remote sensing for atmosphere
9. Remote sensing for ocean
10. Recent trends in remote sensing
11. Exercises in analysis of remote sensing data (1)
12. Exercises in analysis of remote sensing data (2)
13. Exercises in analysis of remote sensing data (3)
14. Exercises in analysis of remote sensing data (4)
15. Exercises in analysis of remote sensing data (5)

[Title]				[Instructor]		
Phenomenology of Environment				Shuji Morita		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328320	2	Sustainable Society Studies		2nd Semester	Tue.／V	Japanese

[Outline and purpose]

We will study how people recognize space with the help of phenomenology and cultural history. You will be asked to pose a problem and discuss it methodologically by seeking proper documents.

[Objectives]

The purpose of this course is to enable you to pose and discuss a problem. You will learn basic notions of some approaches including phenomenology and cultural history.

[Requirements]

[Evaluation]

Homework：20 %
Midterm presentation：40 %
Final presentation and report：40 %

[Textbooks]

There will be weekly handouts.

[References]

オーギュスタン・ベルク『日本の風景・西欧の景観』講談社現代新書

[Schedule]

Through the first part of this course, you will learn basic notions of some approaches including phenomenology and cultural history.
In the second part, you will be asked to give a presentation in order to prepare for the final presentation about a theme you will decide.　Some sessions will take a form of seminar or even face to face consulting.

[Title]				[Instructor]		
Environmental Policy				Susumu Kitagawa		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328370	2	Sustainable Society Studies		1st Semester	Tue.／II	Japanese

[Outline and purpose]

In this course, we will examine environmental politics and policy.

[Objectives]

To deeply understand environmental policy and environmental policy history.

[Requirements]

Basic groundings in environmental policy.

[Evaluation]

Homework : 30 %
Final presentation and report: 70 %

[Textbooks]

No designated textbook.

[References]

Miranda A. Schreurs, *Environmental Politics in Japan, Germany, and the United States,* Cambridge: Cambridge University Press, 2002.

[Schedule]

1. Course Introduction and Overview.
2. - 4. Command & Control Solutions vs. Market Solutions
5. - 7. Case Study: Climate Change
8. - 10. Case Study: Waste Management Policy
11. - 12. History of the Environmental Policy
13. - 14. Student Presentations
15. Summary

[Title]	[Instructor]
Evolutionary Aspect of Organisms and Environment	Taku Misonou

[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
328395	2	Sustainable Society Studies	2nd Semester	Mon.／I	English／Japanese

[Outline and purpose]

To answer to the fundamental question of human being "Where Do We Come From? What Are We? Where Are We Going?" from scientific aspect. Understanding evolutionary biology including evolutionary psychological analysis of human behavior, to consider how to creation of a sustainable society.

[Objectives]

To understand essence of biological evolution.
To understand what kind of organism we are for the analysis of our society.

[Requirements]

The knowledge of biology is not required. A flexible mind accepting new concepts of human being..

[Evaluation]

Presentation and report of the read part of textbook

[Textbooks]

Richard Dawkins, "The Selfish Gene" Oxford University Press, USA; 2 edition (October 25, 1990)
長谷川・長谷川　「進化と人間行動」東京大学出版会（2000/4）
小田亮　「ヒトは環境を壊す動物である」筑摩書房（2004/1）

[References]

[Schedule]

1. Introduction
2-14. Reading a textbook and discussion
15. Summary of the lecture

[Title]	[Instructor]
Advanced Instrumental Analysis	Yasutada Suzuki

[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
328400	2	Sustainable Society Studies	2nd Semester	Tue.／III	Japanese

[Outline and purpose]

It is important to understand the signal and data processing technique in analytical instruments, though it is black-box to the user, because inappropriate use of signal processing will cause erroneous results. In this course, we will study the overview of signal processing in analog and digital domain. In addition to that, the principle and application of various surface analytical instruments using electron beam or X-ray will be provided.

[Objectives]

1. To understand the algorithm of various signal processing methods for both analog (continuous) and digital (discrete) signals.
2. To understand the principle and features of representative surface analytical methods.

[Requirements]

A grounding in basic analytical chemistry, physical chemistry and mathematics.

[Evaluation]

Homework: 10%
Midterm examination: 30%
Final examination: 40%
Classroom attitude: 20%

[Textbooks]

[References]

Signal Processing in Analytical Chemistry, Peter D. Wentzell and Christopher D. Brown
機器分析 三訂版，田中誠之・飯田芳男，裳華房，ISBN-978-4-7853-3133-7

[Schedule]

1. Signal Processing
  1.1 Introduction and analog signal processing
  1.2 Overview of digital filtering and polynomial least-squares smoothing filters
  1.3 Domain transformation (Fourier transform)
  1.4 Wavelet transform and Hadamard transform
  1.5 Midterm examination
2. Surface analysis using electron beam
  2.1 Electron microscopy (SEM/TEM)
  2.2 Electron probe micro analyzer (EPMA)
  2.3 Auger electron spectroscopy (AES)
  2.4 Electron diffraction (LEED, RHEED)
3. Surface analysis using X-ray (X-ray photoelectron spectroscopy)
4. Surface analysis using ion bean
  4.1 Secondary ion mass spectrometry (SIMS)
  4.2 Rutherford back scattering spectroscopy (RBS)
5. Conclusion of surface analysis and final examination

[Title]	[Instructor]
Principles of Ecosystem Biogeochemical Cycles	Tomoya Iwata

[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
328405	2	Sustainable Society Studies River Basin Environmental Science	2nd Semester	Tue./II	Japanese

[Outline and purpose]

This lecture is on ecosystem ecology and biogeochemical cycles on the Earth.

[Objectives]

To deeply understand the biogeochemical cycles in terrestrial, atmospheric and ocean environmetns.

[Requirements]

Basic groundings in Biology and Chemistry.

[Evaluation]

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

[Textbooks]

No designated textbook.

[References]

南川雅男・吉岡崇仁 共編, 生物地球化学, 培風館（in Japanese）
和田英太郎, 地球生態学, 岩波書店（in Japanese）
松久幸敬・赤木右 共著, 地球化学概説, 培風館（in Japanese）
Schlesinger WH (1997) Biogeochemistry–an analysis of global change, Academic Press
Chapin FS III, Matson PA, Mooney HA (2002) Principles of terrestrial ecosystem ecology, Springer

[Schedule]

1. Introduction
2. History of the Earth (1)
3. History of the Earth (2)
4. Evolutional history of life (1)
5. Evolutional history of life (1)
6. Atmospheric environments (1)
7. Atmospheric environments (2)
8. Marine environments (1)
9. Marine environments (2)
10. Terrestrial environments (1)
11. Terrestrial environments (2)
12. Anthropogenic impacts on ecosystems
13. Seminar on ecosystem biogeochemical cycles (1)
14. Seminar on ecosystem biogeochemical cycles (2)
15. Seminar on ecosystem biogeochemical cycles (3)

[Title]	[Instructor]
Environmental Physics	Hiroyuki Shima

[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
328415	2	Sustainable Society Studies	2nd Semester	Thu./I	English

[Outline and purpose]

This class is designed to illustrate many aspects of physics that pervade environmental processes in our everyday lives and in naturally occurring phenomena.

[Objectives]

After completing this course, students should be able:
- To understand how to apply the elementary physics to the human environment,
- To understand Earth as a complex system of interacting "spheres".
- To integrate various traditional scientific disciplines, including mechanics, thermodynamics, and fluid mechanics in the study of the environment.

[Requirements]

To have taken a course in physics in high school
To have mastered elementary calculus and algebra

[Evaluation]

Examination and homeworks：50%
Attitude toward learning：50%

[Textbooks]

Non specified

[References]

数研出版編集部，視覚でとらえるフォトサイエンス物理図録，数研出版（ISBN:978-4410265112)
勝木 渥，物理学に基づく 環境の基礎理論，海鳴社（ISBN:978-4875251903)
J. ハート（著)，小沼通二・蛯名邦禎(監訳)，環境問題の数理科学入門，シュプリンガー・ジャパン株式会社(ISBN:978-4431100850)
中山 正敏，物質環境科学II　環境システムとエントロピー，放送大学教育振興会（ISBN:978-4595133626)
中川 和道、伊藤 真之、蛯名 邦禎，環境物理学，裳華房（ISBN:978-4785322229)

[Schedule]

1. Fluid mechanics
- Pressure (air & water); Buoyant force; Viscosity; Turbulent flow

2. Electromagnetism
- Reflection and refraction of light; Electromagnetic induction; Motor operating mechanism

3. Thermodynamics
- Heat and temperature; Thermal exchange; Energy production; Irreversible process

4. Relativity theory
- The twin paradox; GPS (= Global Positioning System); Nuclear technology

5. Physics of Environment
- Physics of greenhouse warming
- Physics of global material circulation
- Statistical physics of ecology

[Title]				[Instructor]		
Open Systems Technology and Programming				Hiroyasu Toyoki		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328435	2	Sustainable Society Studies		2nd Semester	Fri./II	Japanese

[Outline and purpose]

(1) Through training of programming for Web services using server-side and client-side scripts, students who take this subject master the practical skills of information technology.
(2) Software development methods are lectured. The history of the development methods and the policies for software licenses are also discussed.

[Objectives]

To master the practical skill for object-oriented server-side and client-side programs with utilizing relational database.
To understand major software development methods

[Requirements]

primary programming skill

[Evaluation]

program source codes for some subjects and presentation on his/her codes

[Textbooks]

[References]

shown in the instruction Web page for this subject

[Schedule]

1. Structure of Web service software: server-side and client-side programs
2. Development tools and server-side script language PHP
3. Basics of PHP
4. Object-oriented program: structure of class
5. Inheritance and implementation (1)
6. Inheritance and implementation (2)
7. Manipulating DB
8. JavaScript
9. AJAX
10.-12 Exercise: Building a Web service site on Environmental Information
13 -14. Software development models
15. History of Internet and open source movement
-

[Title]				[Instructor]		
Numerical Computing				Kazuho Ito		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328445	2	Sustainable Society Studies		1st Semester	Mon.／IV	Japanese

[Outline and purpose]

This course treats mathematical analyses for the problems appearing in environmental sciences in two steps: (1) modeling some phenomena of interest with partial differential equations (PDEs), and (2) analyzing the PDE models by numerical methods.

[Objectives]

1. to learn processes of deriving PDE models.
2. to learn how to develop numerical schemes of solving the PDE models.
3. to learn Matlab programing for implementing the schemes.

[Requirements]

Basic groundings in Mathematics (e.g., linear algebra and calculus).

[Evaluation]

Report: 100%

[Textbooks]

No designated textbook.

[References]

[Schedule]

1. Preliminary in calculus (1)
2. Preliminary in calculus (2)
3. Modeling (1): the conservation law
4. Modeling (2): diffusion systems
5. Modeling (3): boundary conditions
6. Modeling (4): wave phenomena
7. Introduction to numerical methods for PDEs
8. Finite Difference methods
9. Numerical schemes for diffusion equations (1)
10. Numerical schemes for diffusion equations (2)
11. Numerical schemes for wave equations
12. Consistency of numerical schemes
13. Stability and convergency of numerical schemes
14. Additional topics in numerical methods and programing
15. Summary

[Title]				[Instructor]		
Advanced Software Engineering				Kentaro Go / Yoshimichi Watanabe		
[Code]	[Credits]	[Program]		[Semester]	[Hours]	[Language of instruction]
328455	2	Computer Science and Media Engineering Embedded and Integrated System Development Sustainable Society Studies		Intensive	／	Japanese

[Outline and purpose]

Recent software development has been moving its target domain from mission-critical information systems to solution design which realizes corporate value creation and improvement through the process of information systems development, operation, and maintenance. The movement requires us to integrate software development and management methodologies to plan, design, develop, operate, and maintain effective information systems. In this lecture, we discuss methodologies for information systems development focusing on efficiency and effectiveness in development. Specifically in the lecture, we explore methodologies for planning, requirements elicitation and analysis as well as operation and maintenance, project management, quality control, and documentation for effective information systems.

[Objectives]

To understand the following topics:
(1) planning of information systems
(2) fundamental concepts of requirements elicitation and analysis of information systems
(3) the overview of maintenance and operation of information systems
(4) techniques for project management in information systems development
(5) the importance of quality control in information systems development
(6) techniques for documentation in information systems development

[Requirements]

Fundamental knowledge on software engineering

[Evaluation]

Quizzes and reports: 100%

[Textbooks]

神長 裕明, 郷 健太郎, 杉浦 茂樹, 高橋 正和, 藤田 茂, 渡辺 喜道: ソフトウェア工学の基礎, 共立出版, 2012 年 (in Japanese).

[References]

ロジャー S. プレスマン: 実践ソフトウェアエンジニアリング, 日科技連出版社, 2005 年 (in Japanese).
小泉 寿男, 吉田 幸二, 辻 秀一, 中島 毅: ソフトウェア開発 (IT Text), オーム社, 2003 年 (in Japanese).

[Schedule]

(01) Introduction, overview and history
(02) Usability and user experience
(03) Service engineering
(04) Scenario and persona based design
(05) Fieldwork
(06) Idea generation
(07) Idea representation
(08) Prototyping
(09) Functional requirements and non-functional requirements (software quality)
(10) Formal specification and informal specification, requirements specification
(11) Software evolution (maintenance and operation)
(12) Quality management
(13) Project management
(14) Risk management
(15) Recent topics, concluding remarks