IESC subjects

Course title <English>	Energy Systems Analysis and Design Energy Systems Analysis and Design
Affiliated department, Job title,Name	Graduate School of Energy Science Professor,TEZUKA TETSUO Graduate School of Energy Science Associate Professor,OGATA SEIICHI
Target year	Master's students
Number of credits	2
Course offered year/period	2019/Second semester
Day/period	Tue.3
Class style	Lecture
Language	English

[Outline and Purpose of the Course]

By Tetsuo TEZUKA, Seiichi OGATA, Department of Socio-environmental Energy Science, Graduate School of Energy Science,

The framework and methodology for energy systems analysis and design in a region and/or/ country, especially related to a model-based approach, are introduced. Furthermore, the theories of energy supply-demand systems are discussed. Participants will develop a simple conceptual model by selecting some energy supply-demand systems as a study target.

[Course Goals]

To understand the basic knowledge and the modeling methodologies of Energy supply-demand systems.

[Course Schedule and Contents]

(1) Statistics of energy supply and demand,
(2) Numerical modeling of energy supply and demand,
(3) What is a system modeling?
(4) Modeling and decision making,
(5) Modeling exercise,
(6) Theoretical approach to energy supply-demand systems,
(7) Liberalization of the energy industry,

[Class requirement]

Nothing

[Method, Point of view, and Attainment levels of Evaluation]

Discussion about modeling of energy systems and report submission.

[Textbook]

Instructed during class

Continue to Energy Systems Analysis and Design (2)↓↓↓

Energy Systems Analysis and Design (2)

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

Student will make a conceptual model for the energy supply-demand systems which the student has selected by himself/herself.
The work for conceptual modeling will be an assignment.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Course title <English>	System Safety System Safety
Affiliated department, Job title,Name	Graduate School of Energy Science Professor,SHIMODA HIROSHI

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.4	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

From the viewpoint of keeping safety and reliability in the context of relationship between advanced technologies and human society, basic knowledge and applications of risk assessment for large-scale and complicated modern energy systems will be lectured.

[Course Goals]

Regarding risk assessment to secure safety of energy systems, the students learn the following knowledge and techniques;
1. Qualitative analysis method of risk.
2. Quantitative risk analysis method of mechanical systems.
3. Human reliability analysis method.

[Course Schedule and Contents]

The following themes will be lectured in regard to basic knowledge and application of risk assessment of large-scale and complicated technology systems.

1. Safety system for social relief (1).
2. Features and problems of large-scale and complicated technology systems (1).
3. Risk assessment of large-scale and complicated technology systems (3).
4. Probabilistic risk assessment(PRA) as quantitative assessment method (6).
5. Basic knowledge of human factor (1).
6. Analysis of human error and its countermeasures (1).
7. Human reliability analysis(HRA) (1).
8. Feedback (1).

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Active participation in the classes (20%),
Exercises in the class and homework (40%),
Final report subject (40%).

Continue to System Safety(2)↓ ↓ ↓

System Safety(2)

[Textbook]

Learning materials will be given in the class.

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

Preparation, review and homework will be given in the class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Course title <English>	Energy Policy Energy Policy
Affiliated department, Job title,Name	Institute for Integrated Radiation and Nuclear Science Professor,UNESAKI HIRONOBU

Target year	Master's students	**Number of credits**	2	**Course offered year/period**	2019/Second semester
Day/period	Wed.1	**Class style**	Lecture	**Language**	English

[Outline and Purpose of the Course]

Energy is dispensable for the welfare of humankind and sound development of social activities in the modern society. The stable supply of energy is influenced by circumstances of political issues and technological development. Based on the mid- to long-term forecast of energy supply and demand, various specific issues related to energy policy, including energy resources, environmental issues, trends in major countries, forecasts and predictions, will be discussed in this course.

[Course Goals]

To achieve ability
- to describe various energy resources used in modern society from both natural and social science,
- to describe the structure and objectives of energy policy of major countries including Japan,
- to comprehensively understand energy statistics and other data and describe it with relation to world energy trends

[Course Schedule and Contents]

1. Overview of energy policy
2. Energy resource: characteristics, supply and demand (1)
3. Energy resource: characteristics, supply and demand (2)
4. Renewable energy: characteristics, policy implementation (1)
5. Renewable energy: characteristics, policy implementation (2)
6. Nuclear energy: characteristics, policy implementation (1)
7. Nuclear energy: characteristics, policy implementation (2)
8. Energy and environment
9. Energy efficiency and energy policy
10. Energy policy of Japan and major countries (1)
11. Energy policy of Japan and major countries (2)
12. Forecasts and outlooks of energy supply and demand (1)
13. Forecasts and outlooks of energy supply and demand (2)
14. Energy poverty, Energy and Water, recent topics
15. Summary

[Class requirement]

Students who have already taken 「**エネルギー政策論**」（3146000）(Spring Semester / in Japanese) are not allowed to take this class.

[Method, Point of view, and Attainment levels of Evaluation]

By attendance (40%) and research presentation / final report (60%).

Continue to Energy Policy(2)↓↓↓

Energy Policy(2)

Note: attendance to research presentation / submission of final report is not allowed in case of class attendance rate is less than 70%

[Textbook]

Handouts will be distributed.

Attendees are recommended to review their own countries' recent energy policy trends, as well as the IEA World Energy Outlook executive summary, which could be downloaded from IEA Web page.

[Reference books, etc.]

（Reference books）

Recommendation of related references (books, reports, journal papers etc) will be given during the class.

[Regarding studies out of class (preparation and review)]

Recent energy situation are extremely fluctuating and dynamic; attendees are recommended to collect up-todate information on energy policy and related topics.

（Others (office hour, etc.)）

- Technical tour to power plants and energy-related facilities may be included as a part of the class.

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63170 SE28				
Course title <English>	Future Energy:Hydrogen Economy Future Energy:Hydrogen Economy			Affiliated department, Job title,Name	Graduate School of Energy Science Associate Professor,MCLELLAN, Benjamin
Target year	Master's students	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Wed.1	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

This course will introduce the concepts and technology of the Hydrogen Economy. The course is intended to give insight into this topical area of research and its potential benefits and impacts.

[Course Goals]

The aim for the class is for students to understand each of the major phases in hydrogen energy infrastructure, and the main technologies considered. Students will learn technical, social, environmental and economic aspects of the systems. Through class discussions and a final report, students will hone their skills in argument and learn to identify critical criteria for technology assessment.

[Course Schedule and Contents]

The course will consist of lectures on key supporting technologies and system-wide aspects of hydrogen energy systems. The following themes will be discussed (order may change):

1. The history of the hydrogen economy
2. Hydrogen production - current and emerging [2 weeks]
3. Hydrogen utilization (high and low temperature fuel cells, other engines and chemical processes) [3 weeks]
4. Hydrogen storage and distribution
5. Hydrogen systems configurations
6. Economics of a hydrogen economy
7. Social aspects of a hydrogen economy
8. Environmental aspects of a hydrogen economy

Two in-class discussion sessions will be integrated (timing specified in first class).

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Three items of assessment are used (shown below). The specific requirements and assessment criteria are distributed in class.

Final report (Technology assessment in a specific country context) [60%]
Class discussion 1 - Hydrogen production (Discussion and handout) [15%]
Class discussion 2 - Hydrogen storage and utilisation (Discussion and handout) [25%]

Continue to Future Energy:Hydrogen Economy(2)↓↓↓

Future Energy:Hydrogen Economy(2)

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

Students will need to spend time researching a specific allocated country`s energy system and determining how to develop an appropriate hydrogen economy. This will be particularly before each class discussion.

（Others (office hour, etc.)）

Basic knowledge of energy concepts and ability to apply mathematics is required.
Contact may be made via email for out-of-class discussion.

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63174 LE17				
Course title <English>	Energy, materials and resources Energy, materials and resources		Affiliated department, Job title,Name	Graduate School of Energy Science Associate Professor,MCLELLAN, Benjamin	
Target year	Master's students	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Thu.3	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

Energy and materials are vitally linked, in their production and utilisation, and are crucial for society. All energy and materials are ultimately reliant on various resources, principal among which are the non-renewable mineral resources. This course will examine the bi-directional link of materials and energy, and the resources on which they are dependent - particularly critical minerals.

[Course Goals]

Students will obtain an understanding of various materials and the energy use in their production, as well as the use of various materials in energy systems. The concepts of material criticality will be introduced, and the students will obtain an understanding of the key elements of criticality assessment and its strategic importance.

[Course Schedule and Contents]

The general course topics will be as follows:
1. Overview of materials, energy and resources
2. Typical materials and energy lifecycles (1-2weeks)
3. Resource types and models (1-2weeks)
4. Material criticality 1 - Vulnerability to Supply Restriction (2 weeks)
5. Material criticality 2 - Supply Risk (2 weeks)
6. Material criticality 3 - Environmental Impacts
7. Recycling and renewability
8. Substitutes and substitutability
9. Energy scenarios and materials (2 weeks)
10. Resource curse and social implications of energy

The exact order of topics may change. Some additional topics - particularly classes with a focus on a particular material - may be added.

The final class will have student presentations.

[Class requirement]

None

Continue to Energy, materials and resources(2)↓↓↓

Energy, materials and resources(2)

[Method, Point of view, and Attainment levels of Evaluation]

Evaluation in the subject will be based on:
Class performance: attendance and short exercises (30%)
Final week presentation (20%)
Final report (50%)

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

[Regarding studies out of class (preparation and review)]

Some short exercises will be provided for students to undertake out of class.
Pre-reading may be provided.

（Others (office hour, etc.)）

Office hours are not set - consultation is available by prior appointment.

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63167 SE17		
Course title <English>	Energy and SD Energy Systems and Sustainable Development	Affiliated department, Job title,Name	Graduate School of Energy Science Associate Professor,MCLELLAN, Benjamin

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

This course will introduce key concepts of sustainable development, and engage students in understanding the interconnections of energy systems in the larger picture of sustainable development. The course finishes with a workshop applying these concepts to energy systems planning.

[Course Goals]

The goals of the course are for students to understand the breadth and complexity of sustainability and its implications for energy systems. Students will learn key concepts and frameworks, and apply critical thinking and team processes to the planning of sustainable energy systems in a given context. Technical, environmental and socio-economic topics and approaches will be covered.

[Course Schedule and Contents]

The course will consist of lectures and interactive sessions on the following key themes (order to be clarified in first session):
1. Sustainable development and sustainability concepts
2. Frameworks for understanding sustainability
3. Life cycle assessment of energy systems (and connections with water, pollution and resource usage) [2-3 weeks]
4. Non-renewable energy technology
5. Renewable energy technology
6. Energy in developing countries
7. Infrastructure configurations for energy delivery
8. Transitions of energy systems
9. Measurement and decision making for sustainability (2 weeks).

Followed by 2-3 weeks of workshop.

[Class requirement]

None

Continue to Energy and SD(2)↓ ↓ ↓

Energy and SD(2)

[Method, Point of view, and Attainment levels of Evaluation]

Students will be evaluated on three major elements:
1. Participation in class activities and submission of out-of-class tasks aimed to solidify learning of concepts (40%)
2. Participation in the 3 week workshop capping-off the course (30%)
3. Submission of a final report (30%)

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

Suggested reading:
Sustainable Energy: Choosing among options (Tester et al., 2005)

[Regarding studies out of class (preparation and review)]

Students will be required to do occasional out-of-class preparation exercises.
Slides will be provided before the lecture via PandA so that pre-reading can be undertaken.
Other references will be given in class.

（Others (office hour, etc.)）

Available by appointment.

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63249 LE59		
Course title <English>	Fundamental Plasma Simulation Fundamental Plasma Simulation	Affiliated department, Job title,Name	Graduate School of Energy Science Professor,KISHIMOTO YASUAKI

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.5	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

This lecture aims at formally introducing basic statistical description of wide class of plasma. Characteristics of individual and collective behaviors of plasmas and that of associated fluctuation and dissipation are studied following kinetic modeling, which are the basis of numerical simulation of plasmas in magnetically confined fusion plasmas, laser-plasma interaction, space plasmas and astrophysical physics.

[Course Goals]

1.Understanding of plasma based on kinetic model and of the individual and collective characteristics.
2.Understanding of the dispersion relation in plasma and specifically wave-particle interaction emphasizing on Landau damping.
3.Understanding of the characteristics of fluctuation and dissipation in plasmas based on the statistical approach and the role on plasma numerical simulation.

[Course Schedule and Contents]

The class will be arranged as a seminar style according to following subjects.
1.Definition of plasma and the concept as the fourth state of the matter (2 weeks)
2.The role of plasma in nature and laboratory and the concept of confinement (2 weeks)
3.Fluid and kinetic description of plasma (2 weeks)
4. Statistical characteristics of plasma characterizing individual and collective dynamics (2 weeks)
4. Basics of plasma simulation and the methodology (3 weeks)
5. Large scale simulation of turbulence transport in fusion plasma (3 weeks)

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Report

[Textbook]

Instructed during class

[Reference books, etc.]

（Reference books）

・S.Ichimaru, Basic Principle of Plasma Physics:A Statistical Approach, Frontiers in Physics Lecture Note

Continue to Fundamental Plasma Simulation(2)↓↓↓

Fundamental Plasma Simulation(2)

Series

- L. Landau,"On the vibration of the Electric Plasma", J.Phys.U.S.S.R.10, 25 (1946)

[Regarding studies out of class (preparation and review)]

Basic knowledge: Electromagnetics; Fundamental course of plasma physics.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

subject number			
Course title <English>	Advanced Energy Conversion Science Advanced Energy Conversion Science	Affiliated department, Job title,Name	Graduate School of Energy Science 変換科学専攻教員全員 Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI

Target year	修士・博士	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.3	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

Subjects on the conversion, control and utilization of various kinds of energy from viewpoints of science and engineering are offered.

[Course Goals]

To understand subjects on the conversion, control and utilization of various kinds of energy

[Course Schedule and Contents]

Latest topics about energy conversion systems and their functional design are lectured in an omnibus class.

- Thermal Efficiency and Pollutant Emissions in Internal Combustion Engines
- Fundamental Research for Advanced Combustion Systems
- Laser Diagnostics for Combustion Research
- Ceramics and Their Applications to Energy-Related Machineries
- Energy Components and High Temperature Machine Design
- Nondestructive Evaluation for Energy Equipment and Materials
- Fusion Energy Conversion
- High temperature liquids for energy conversion
- Energy Conversion System for Electromagnetic Waves and Particle Beam
- Modeling of Radiation Damage Processes in Fusion Materials

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Attendance and report

[Textbook]

Additional articles and documents are delivered if necessary.

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

To be announced in class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63392 LE28 G-ENE20 63392 LE77				
Course title <English>	Fusion Energy Science and Technology Fusion Energy Science and Technology	Affiliated department, Job title,Name	Institute of Advanced Energy Professor,KONISHI SATOSHI Institute of Advanced Energy Professor,NAGASAKI KAZUNOBU		
Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.1	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

Subjects on the science and technology of the latest information on the development of fusion energy are offered from viewpoints of energy generation, technology, material and utilization

[Course Goals]

To understand basic knowledge and latest topics on energy generation, conversion, control and utilization of fusion energy from the aspect of technology, materials and application.
To analyze and critically evaluate the energy systems technology on which each students will be studying, and to discuss a strategy of study from social, technical, environmental and sustainability aspects.

[Course Schedule and Contents]

Latest topics about the development of fusion reactor, its energy conversion systems, and material issues are lectured.
1. Fusion Energy Conversion (Konishi)
 • Development of Fusion Devices: Recent progress of fusion development on the confinement of high temperature plasma and extraction of the product energy and plant systems.
 • Fusion Energy Conversion System:Technology of converting fusion energy to electricity, heat and fuel production. Environmental impact, safety, economics and social aspect of fusion will also be explained.
2. Control of fusion energy (Nagasaki)
 • Ignition condition
 • Magnetic confinement system
 • Confinement, transport and stability
 • Plasma heating
 • Current status of fusion plasma experiments
3. Recent Progress in Fusion Structural Materials R&D (Kimura)
 • Material requirements for fusion application
 • Fusion blanket structural materials
 • Effects of high energy neutron irradiation
 • Current status of fusion materials R&D
 • Future prospect of fusion energy

[Class requirement]

None

Continue to Fusion Energy Science and Technology(2)↓↓↓

Fusion Energy Science and Technology(2)

[Method, Point of view, and Attainment levels of Evaluation]

Attendance and report(term paper)

[Textbook]

Original materials are provided.Some materials are available on the web with limited access.

[Reference books, etc.]

（Reference books）

to be introduced in the lecture

[Regarding studies out of class (preparation and review)]

Occasional homeworks may be given to consider an energy related topics.

（Others (office hour, etc.)）

always available upon appointments.

*Please visit KULASIS to find out about office hours.

subject number	G-ENE20 63393 LE28 G-ENE20 63393 LE71 G-ENE20 63393 LE77		
Course title <English>	Energy Conversion System Design Energy Conversion Systems and Functional Design	Affiliated department, Job title,Name	Graduate School of Energy Science Professor,ISHIYAMA TAKUJI Graduate School of Energy Science Professor,HOSHIDE TOSHIHIKO Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Energy Science Professor,KAWANABE HIROSHI

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.1	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

Subjects on the conversion, control and utilization of various kinds of energy from viewpoints of science and engineering are offered.

[Course Goals]

To understand problems, measures and their academic backgrounds in technologies for improving energy conversion efficiencies with greater safety and reliability of energy systems.

[Course Schedule and Contents]

Latest topics about energy conversion systems and their functional design are lectured.

1. Thermal Efficiency and Pollutant Emissions in Internal Combustion Engines (3-4 weeks)
 - Fundamentals of reciprocating internal combustion engines
 - Spark-ignition and diesel engines
 - Technologies for clean and high-efficiency engines

2. Strength Analysis for Design of Energy-Related Structures (3-4 weeks)
 - Fundamentals of fracture mechanics for structural design
 - Fatigue properties of metallic materials
 - Characteristics of ceramics strength

3. Modeling and Analyses of Solids and Structures (3-4 weeks)
 - Elements of continuum mechanics
 - Constitutive modeling of complex materials
 - Computational mechanics of solids and structures

4. Modeling and Diagnostics of Combustion Process (3-4 weeks)
 - Fundamentals of combustion
 - Laser diagnostic techniques
 - Numerical simulation of combustion process

Continue to Energy Conversion System Design(2)↓↓↓

Energy Conversion System Design(2)

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

The evaluation is based on attendance and report. The report subject will be provided by each lecturer. Both the attendance rate and the result of report are important for the final score.

[Textbook]

Handouts

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

To be announced in class if necessary.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

subject number			
Course title <English>	Applied Chemistry for Biomass Conversion Applied Chemistry for Biomass Conversion	Affiliated department, Job title,Name	Graduate School of Energy Science Program-Specific Assistant Professor,QU, Chen

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.3	Class style		Language	English

[Outline and Purpose of the Course]

Biomass is a renewable and abundant feedstock, which has the potential to become a future alternative to fossil resources. This course is aimed at introducing the basic knowledge of biomass, providing overview of biomass processing chemistry, and illustrating biomass conversion strategies for value-added chemicals, fuels and materials.

[Course Goals]

To understand the principal concepts and developments in wood chemistry and biomass conversion technology.

[Course Schedule and Contents]

1. Chemical composition and distribution of biomass
2. Cellulose: chemistry and its characterization
3. Lignin: chemistry and its characterization
4. Biomass conversion into energy
5. Bioethanol production
6. Green chemistry approach towards the biomass conversion
7. Thermochemical biomass conversion

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Evaluation will be based on oral presentation and reports (60 points) and class performance (40 points).
Oral presentation and reports will be assessed on the basis of achievement level for course goals.
Evaluation for class performance includes attendance and active participation.
Evaluated results of the points should be 60 and above out of 100.

60 and above: Passed
59 and below: Failed

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

Chinnappan Baskar, Shikha Baskar, Ranjit S. Dhillon 『Biomass Conversion -The Interface of

Continue to Applied Chemistry for Biomass Conversion(2)↓↓↓

Biotechnology, Chemistry and Materials Science』（Springer）
David N.S. Hon, Nobuo Shiraishi 『Wood and Cellulosic Chemistry』（CRC Press）
EERO SJÖSTRÖM 『Wood Chemistry - Fundamentals and Application』（Elsevier）

[Regarding studies out of class (preparation and review)]

Depending on the progressive of the course, attendees will conduct a research and consider their assigned parts.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

subject number			
Course title <English>	Polymer Chemistry for Energy Science Polymer Chemistry for Energy Science	Affiliated department, Job title,Name	Graduate School of Energy Science Program-Specific Assistant Professor,OKAZAKI YUTAKA

Target year	Master's students	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.2	Class style		Language	English

[Outline and Purpose of the Course]

This course will focus on polymer chemistry, which is an essential subject to design and characterize the organic-, inorganic-, and/or their composite-materials in relation to energy science.

[Course Goals]

To understand the basic concepts and theories of polymer chemistry, which is an essential subject to design and characterize the organic-, inorganic-, and/or their composite-materials in relation to energy science.

[Course Schedule and Contents]

In principal, the course will be offered as the following plan. However, it may change the order or the number of times for each theme depending on the progressive of the course.
(1) What is “Polymers”?
(2) Basic properties of polymers
(3) Polymerization
(4) Polymer gels
(5) Supramolecular polymers
(6) Inorganic polymers
(7) Carbon materials
(8) Biopolymers
(9) Polymers for solar cells
(10) Polymers for fuel cells
(11) Polymers for vehicles
(12) Polymers for LEDs

[Class requirement]

None

[Method, Point of view, and Attainment levels of Evaluation]

Evaluation will be based on oral presentation and reports (80 points) and class performance (20 points). Oral presentation and reports will be assessed on the basis of achievement level for course goals. Evaluation for class performance includes attendance and active participation.

Continue to Polymer Chemistry for Energy Science(2)↓↓↓

Polymer Chemistry for Energy Science(2)

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

Introduced during class

[Regarding studies out of class (preparation and review)]

Depending on the progressive of the course, attendees will conduct a research and consider their assigned parts.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.