Numbering code			
Course title <English>	工学倫理 Engineering Ethics	Affiliated department, Job title,Name	Graduate School of Energy Science Professor,TAKUDA HIROHIKO Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU

Target year	4th year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Thu.3	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Modern ethics based on engineering aspect are becoming essential to present engineers and scientists. Instructors from various faculties give lectures about ethics in their research fields.

[Course Goals]

The goal of this class is to understand engineering ethics, and to develop the ability to judge by yourself when you encounter ethical issues.

[Course Schedule and Contents]

Significance to learn engineering ethics. (4/11) 1time. As an introduction to this course, the meaning of engineering ethics and the significance to learning it are explained. Examples are shown in building engineering area on daily disastrous accidents and fire event. The significances of engineering ethics to those examples are discussed. (K. Harada: Architecture)
Geotechnical engineering and engineering ethics. (4/18) 1 time. Geotechnical Engineering is indispensable in discussing the underground public use, slope stability, geo-sequestration of byproduct for the energy generating. Introducing some examples of natural disasters and construction accidents, geotechnical engineering and engineering ethics will be discussed. (K. Kishida: Global Engineering)
Engineering ethics as an applied ethics. (4/25) 1 time. In this lecture, I will show the basic Idea of Engineering Ethics by comparing with the other fields of Applied Ethics. And show its unique character in the age of information technology. (M. Mizutani: Graduate School of Letters)
Ethical theories for engineering ethics. (5/2) 1 time. This lecture focus on various ideas in ethics (utilitarianism, deontology, virtue ethics, professional ethics etc.) which will be useful for thinking about particular ethical problems in engineering ethics. (T. Iseda: Graduate School of Letters)
Art-view concept for engineering. (5/9) 1time. Concept of "quality of life" is required for human related engineering. Some practical examples in medical-care and welfare fields will be introduced, and problem of the QOL-evaluation will be discussed from both function-optimizing view point and art view point. (N. Tomita: Engineering Science)
Ethics of biotechnology and stem cell research. (5/16) 1time. With the rapid development of genome editing technology and stem cell engineering, editing of the human genome that goes beyond generations has become possible, at least technically. In this lecture, I will introduce these latest technologies and think about ethical problems accompanying technological development. (G. Eiraku: Industrial Chemistry)
Research and engineering ethics. (5/23) 1time. It is said that He that will do no ill, must do nothing that belongs thereto. The sense of ethics necessary to whom conducts research and engineering work in society is discussed in terms of the importance of equitability and fair evaluation to anyone involved in each area of research or engineering. (H. Mikada: Global Engineering)
Ethics in biomedical engineering. (5/30) 1time. Recent dramatic progress in biology-related techniques, such as reproductive medicine, genome editing, and clone-animal techniques, is causing revolutions in the fields of

Continue to 工学倫理(2)↓↓↓

工学倫理(3)

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

The assignment of the report will be given for each lesson.

（Others (office hour, etc.)）

The class order is subject to change.

*Please visit KULASIS to find out about office hours.

工学倫理(2)

medicines and food productions. Associated with it, problems of their safety and ethics are arising, which should be addressed by our societies. In this class, the recent progress in biology-related techniques, and problems we have and will have in near future are described. (M. Shirakawa: Industrial Chemistry)
Patents and ethics (Part 1). (6/6) 1time. This course will teach the students about 1) patent systems which protect inventions and research results and 2) ethical issues in patents. The first class, in preparation for the next subject of patent ethics, introduces Japan's patent system with comparisons to the patent systems in the world's major countries and international framework. (M. Nakagawa: Electrical and Electronics Engineering)
Patents and ethics (Part 2). (6/13) 1time. Students, equipped with the basic knowledge of patent systems by the previous lecture, will get familiar with actual case studies on ethical and legal issues in patents. (M. Nakagawa: Electrical and Electronics Engineering)
Ethics required for advanced science. (6/27) 1time. Engineers and researchers are at the forefront of preventing harm caused by advanced chemistry. Think about social roles and ethics required by engineers and researchers through relationships between chemical substances and environmental problems, efforts to avoid hazards of nanomaterials. (K. Miura: Industrial Chemistry)
Ethics in press release. (7/4) 1 time. Press Release is an essential process for introducing the research to our society through various medias. In this lecture, issues related to Press Release in University are addressed and discussed. (K. Umeno: Informatics and Mathematical Science)
Failure accidents and inspection/maintenance (7/11) 1time. On the occasions of failure accidents of vehicles and plants, the appropriateness of inspection/maintenance of their structures is often questioned. Some actual failure accidents are reviewed to discuss the importance of inspection/maintenance together with the relation to engineering ethics. (S. Biwa: Engineering Science)
Ethics in nuclear engineering. (7/18) 1time. Discussion on engineering ethics in the TEPCO accident from view point of Tsunami evaluation by the Japanese government. (I. Takagi: Engineering Science)
Ethical issues on sound design. (7/25) 1 time. Every working things consuming energy emits acoustic sound. Even a small sound energy affect human as noise and may create annoyance and health problems. Sound problems of various things are introduced in the lecture. Ethical issues, which shall be considered during design and operation environment, will be discussed. (Y. Takano: Architecture)

[Class requirement]

None

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

Class participation and reports.

[Textbook]

Lecture materials will be distributed.

[Reference books, etc.]

（Reference books）

『Omnibus Engineering Ethics』（Kyoritsu Shuppan Co., Ltd.）ISBN:978-4320071964
『Practical Engineering Ethics - A Short Course, New Edition』（Kagaku-Dojin Publishing Company,INC）ISBN:9784759811551
『Engineering Ethics (Revised Edition)』（CORONA PUBLISHING CO.,LTD.）ISBN:978-4-339-07798-8
『World of Engineering Ethics (3rd Edition)』（Morikita Publishing Co., Ltd.）ISBN:978-4-627-97303-9

Continue to 工学倫理(3)↓↓↓

※

Numbering code			
Course title <English>	工学序論 Introduction to Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Senior Lecturer,MAEDA MASAHIRO Graduate School of Engineering Senior Lecturer,MATSUMOTO RIYOUSUKE Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,ASHIDA RIYUUICHI

Target year	1st year students or above	Number of credits	1	Course offered year/period	2019/Intensive, First semester
Day/period	Intensive	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1~2times,
,6times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	ＧＬセミナーＩ（企業調査研究） Global Leadership Seminar I	Affiliated department, Job title,Name	Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI Graduate School of Engineering Senior Lecturer,MAEDA MASAHIRO
Target year	2nd year students or above	Number of credits	1
Course offered year/period	2019/Intensive, year-round		
Day/period	Intensive	Class style	Seminar
Language	Japanese		

[Outline and Purpose of the Course]

The purpose of this course is to study about how worldwide leading company, institute, etc. make proposals and find solutions for expanding their own technologies to the international market. Throughout hands-on training on their laboratory, students investigate the methodology of team organization, proposal, market prediction and conception ability by group works. After the investigation, students are expected to improve their comprehension and explanation capability. As extended exersice subject of this course, the Global Leadership Seminar II is opened in the second semester.

[Course Goals]

The goal of this course is to improve student's comprehension and explanation capability for processes of proposal and expantion on the international market invesitgating worldwide leading companies by group work.

[Course Schedule and Contents]

Week 1, Guidance
Week 2-13, Hands-on training
Week 14, Pre-presentation
Week 15, Final presentation

[Class requirement]

How to register will be announced later. Students who want to join this course is requested to attend the first class.

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

Students are prohibited to skip hands-on training. Evaluation will be based on presentation.

[Textbook]

Not used

Continue to ＧＬセミナーＩ（企業調査研究）(2)↓↓↓

※

Numbering code			
Course title <English>	工学部国際インターンシップ１ Faculty of Engineering International Internship 1	Affiliated department, Job title,Name	Approved
Target year	3rd year students or above	Number of credits	1
Course offered year/period	2019/Intensive, year-round		
Day/period	Intensive	Class style	Seminar
Language	Japanese and English		

[Outline and Purpose of the Course]

Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Faculty of Engineering, or the undergraduate school the applicant belongs to.

[Course Goals]

The acquisition of international skills with the training of foreign language through the to internship programs hosted by the University is the major expectation to the students.

[Course Schedule and Contents]

Overseas Internship,1time,The contents to be acquired should be described in the brochure of each internship program.
Final Presentation,1time,A presentation by the student is required followed by discussion among participants.

[Class requirement]

Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

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

Marit rating is done based on the presentation or reports after each internship program. Each **D**epartment responsible to identify if the credit earned by this subject to be included as mandatory ones or not. If the credit is not included in the undergraduate school in which the participant belongs to, the credit is granted by the Global Leadership Education Center as a optional credit. The number of credits, either 1 or 2, will be determined depending on the contents and the duration of the program that the participant has participated in.

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the undergraduate school or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

*Please visit KULASIS to find out about office hours.

ＧＬセミナーＩ（企業調査研究）(2)

[Reference books, etc.]

（Reference books）

（Related URLs）

http://www.glc.t.kyoto-u.ac.jp/ugrad

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

Investigating companies in advance. Analyzing the result from hands-on training. Preparing presentation.

（Others (office hour, etc.)）

How to register will be announced later. Students who want to join this course is requested to attend the first class. Students are prohibited to skip hands-on training. Evaluation will be based on presentation.

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	ＧＬセミナーＩＩ（課題解決演習） Global Leadership Seminar II	Affiliated department, Job title,Name	Graduate School of Engineering Senior Lecturer,MAEDA MASAHIRO Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU
Target year	2nd year students or above	Number of credits	1
Course offered year/period	2019/Intensive, Second semester		
Day/period	Intensive	Class style	Seminar
Language	Japanese		

[Outline and Purpose of the Course]

This course is a small-group workshop program where students are supposed to extract or set up challenges by themselves aiming at creating new social values. In concrete, abilities of planning and problem-solving are trained through group works in residential training and skills of presentation and communication are enhanced through oral presentations regarding contents of the proposal at each step of the process from a preliminary draft to its completion.

[Course Goals]

Ability of planning, from extraction or setting up challenges to proposal of solutions aiming at creating new social values, is trained through group works.

[Course Schedule and Contents]

Orientation,1time,A brief overview and a schedule of the course are explained and working groups are organized.
Lectures,2times,Lectures by experts are given.
Group works,3times,Setting up challenges, extraction of problems, collecting information, and group works are done.
Residential training,7times,Through intensive group works based on discussion, a proposal for solving problems is planned, a draft report is made, and a few presentations are made.
Preliminary review meeting,1time,A preliminary review meeting is held and discussions are made.
Report meeting,1time,Final presentations are made and reports are submitted.

[Class requirement]

None

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

It is required to join the residential training. A report meeting is held and comprehensive evaluation concerning abilities in group discussion to extract or set up challenges and to propose solutions for achieving a goal is made through presentation of the proposal as well as a submitted report.

[Textbook]

Will be indicated as necessary.

Continue to ＧＬセミナーＩＩ（課題解決演習）(2)↓↓↓

ＧＬセミナーＩＩ（課題解決演習）(2)

[Reference books, etc.]

（Reference books）

Will be indicated as necessary.

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

（Others (office hour, etc.)）

Course open period: October to January
How to register the course will be instructed.
*It depends on divisions which students belong to whether the earned credits are admitted as credits required for graduation. Please refer to the syllabus of your division.

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	有機工業化学 Industrial Organic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,TANAKA TSUNEHIRO Graduate School of Engineering Professor,OOE KOUICHI Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,KONDOU TERUYUKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, 2 times,
,2times,
,3times,
,2times,
,1time,
,2times,
, 2 times,
,1time,

[Class requirement]

None

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

Continue to 有機工業化学(2)↓↓↓

※

Numbering code			
Course title <English>	工学部国際インターンシップ２ Faculty of Engineering International Internship 2	Affiliated department, Job title,Name	Approved

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Intensive, year-round
Day/period	Intensive	Class style	Seminar	Language	Japanese and English

[Outline and Purpose of the Course]

Acqusition of international skills with wth the training of foreign language through the participation to the international internship programs held by the Faculty of Engineering or its subsidiary bodies.

[Course Goals]

The acquisition of international and foreign language skills through the participation to international programs is expected. Detailed objectives of the participation should be identified by each program.

[Course Schedule and Contents]

Overseas Internship,1time,The contents to be acquired should be described in the brochure of each internship program.
Final Presentation,1time,A presentation by the student is required followed by discussion among participants.

[Class requirement]

Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

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

Marit rating is done based on the presentation or reports after each internship program. Each Department responsible to identify if the credit earned by this subject to be included as mandatory ones or not. If the credit is not included in the undergraduate school in which the participant belongs to, the credit is granted by the Global Leadership Education Center as a optional credit. The number of credits, either 1 or 2, will be determined depending on the contents and the duration of the program that the participant has participated in.

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the undergraduate school or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

*Please visit KULASIS to find out about office hours.

有機工業化学(2)

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	生物化学工学 Biochemical Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,UMEDA MASATO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU Graduate School of Engineering Associate Professor,MASAYUKI MORI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Fri.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,4times,
,3times,
,3times,
,4times,
,1time,

[Class requirement]

None

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

[Textbook]

Continue to 生物化学工学(2)↓↓↓

Numbering code			
Course title <English>	環境保全概論 Introduction to Environment Preservation	Affiliated department, Job title,Name	Agency for Health, Safety and Environment Professor,HASHIMOTO SATOSHI Agency for Health, Safety and Environment Professor,SAKAI SHINICHI Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

This course is designed for students specializing in chemistry.
Students will study basic examples of environmental issues and their effects on society from the perspective of preservation of the environment at the university, the air environment, the aquatic environment, and a sound material-cycle society. We will help develop students ’ understanding of environmental preservation for their future research and social activities.

[Course Goals]

The major course objectives:
(1) To learn the background and basic mechanisms of environmental problems, specifically as they relate to air and water, as well as how to establish a sound material-cycle society.
(2) To understand relationships between various activities and their environmental impacts on campus.

[Course Schedule and Contents]

1. Environmental Issues of Our Time, 3 times
With a particular focus on chemicals, we will study the background and current status of environmental issues and discuss possible future problems. We will also examine how environmental issues are related to human activities and resource/energy consumption.

2. Environment Preservation at Kyoto University, 2 times
Students will learn about environmental protection systems at Kyoto University. We will explain systems for water quality control, liquid waste treatment, and specially controlled waste management. We will also detail systems and regulations for proper use and management of chemical substances.

3. Air Environment, 5 times
We will discuss the current status of global air pollution. We will learn about a variety of regulations and the relevant background of rules created based on the Air Pollution Control Law. We will discuss in detail air pollutants emitted by factories and automobiles in urban areas and look closely at their chemical reactions in the air, with a particular focus on radical reactions.

4. Aquatic Environment, 2 times
Students will study the conservation of water quality, specifically (1) water contamination by organic substances and related purification methods, (2) water contamination by heavy metals and related treatment methods, and (3) management of environmentally persistent substances. They will also learn about environmental criteria, effluent standards, and environmental protection technologies for water quality

Continue to 環境保全概論(2)↓↓↓

生物化学工学(2)

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

環境保全概論(2)

control.

5. Waste Management and a Sound Material-Cycle Society, 2 times
Students will develop a better understanding of waste treatment/management and a sound material-cycle society by studying (1) mass balance and indexes on the macro level, (2) definitions of waste and the current status of waste treatment, (3) waste and dioxin problems, and (4) approaches toward establishing a sound material-cycle society.

6. Confirmation of students' levels of understanding, 1 time
Students ’ level of understanding of course topics will be checked.

[Class requirement]

None

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

Evaluation: test scores + attendance rates.

[Textbook]

Not specified. Materials and references will be distributed in class when needed.

[Reference books, etc.]

（Reference books）

To be announced in class.

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

Review on the materials and references distributed. Specified points willbe announced in class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	環境安全化学 Chemistry and Environmental Safety	Affiliated department, Job title,Name	Agency for Health, Safety and Environment Professor,HASHIMOTO SATOSHI Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI Graduate School of Engineering Professor,ABE RYUU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Thu.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2-3times,
,2-3times,
,2-3times,
,2-3times,
,2-3times,
,2-3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	プロセス制御工学 Process Control	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOSHIMA MASAHIRO Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Assistant Professor,KIM SANGHONG

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Wed.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Process control is used for operating the production processes in chemical and the steel industries. Pressure, temperature, liquid level and flow rate are major process variables to be controlled automatically (i.e., computers). Understanding the process dynamics is the first step to develop a good control system. Then, as the second step, the optimal selection and manipulation of the process input variables has to be determined. The class teaches to derive the physico-chemical dynamic models of chemical processes and transfer function models, which are obtained by taylor expansion of the physico-chemical models. Then, the design scheme of controller is described. To make the understanding easier, computer simulation exercises using Matlab and Simulink are offered. 1.

[Course Goals]

The goal of the class is to educate the students to be able to develop the dynamic process model, design the process controller and to analyze the control performance so as to design the optimal process control systems.

[Course Schedule and Contents]

Introduction of Process Control,1time,Showing several examples, the necessity, objectives and importance of process control are described. Then, the concepts of feedback and feed-forward controls and technical terms on process control are explained. Some issues on process control design are explained. The basic design procedure of the control system for solving the issues is explained.
Development of Dynamic Models,1time,The first step for developing better process control systems is to understand the dynamic behaviors of the process to be controlled. The modeling method using the material and heat balance equations is lectured to construct the model showing the dynamic behavior of the process appropriately. Then, how to derive the linear transfer model using Taylor expansion of the first principle model is explained.
Laplace transform and Transfer function,1time,The Laplace transform is revisited first. Then, how to derive the transfer function from the linearized dynamic model among the input and the output variables is lectured. How to obtain the linear model from the step response is also taught.
Exercise with Matlab for learning dynamic behavior,1time,[Exercise] After learning the basics of Matlab and Simulink, the dynamic behaviors of some typical dynamic systems such as the first-order lag system and the second-order lag system are simulated. Then, for a given process, the exercise on developing the model and executing the simulation is executed.
PID Control,1time,The most popular controller in process industries is PID (Proportional, Integral, and Derivative) controller. The basic features of three elements (P, I, D) are explained. Then, after explaining the basic feature of PID controller, how to adjust the control parameters is taught.
Dynamics of controlled system,1time,The relationship between the pole of the transfer function and the stability is lectured. Then, the basic feature, the steady-state characteristics, and the stability of the feedback control system are explained.

Continue to プロセス制御工学(2)↓↓↓

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Numbering code			
Course title <English>	移動現象 Transport Phenomena	Affiliated department, Job title,Name	Graduate School of Engineering Professor,YAMAMOTO RYOICHI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,5times,
,5times,
,4times,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

プロセス制御工学(2)

Mid-term exam,1time,To know the level of understanding, the mid-term examination is conducted.
Frequency response,1time,The relationship between the sine wave input and the output (the frequency response), and how to detect the stability from the frequency response are lectured. The features of various filters are also explained.
PID control system design ,1time,The adjusting method of PID parameters based on the IMC control procedure is explained. Then, several revised controllers of the basic PID controller for improving the performance are lectured.
Exercise of control system design ,1time,[Exercise] For a given process, the exercise of tuning the control parameters and verifying the performance under the developed system using Matlab/Simulink is executed.
Cascade control and Multi-loop control,1time,The concept of cascade control is explained. Then, as a control system dealing with the two-input and two-output process, the multi-loop control system is introduced, and how to remove the interaction among the control loops is explained.
Exercise of multi-loop control,1time,[Exercise] For a given process, the exercise of developing a controller for a two-input and two-output process is executed.
Equipment for control,1time,The equipment used for the real process control system are explained. The concept of proportional band and the reason why non-dimensional system is used are explained.
Overall exercise of process control design,1time,[Exercise] Starting with the construction of the first principle model of a chemical/bio process, a two-input and two-output control system (multi-loop controller) is designed and the parameters are tuned by using Matlab and Simulink
Feed-back time, **1** times,The question and answer to the final exercise, and the whole of the lectures are conducted.

[Class requirement]

Basic understanding of linear algebra, ordinal differential equations and Laplace transform

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

The score is determined by considering the quality of homeworks, midterm exam, term-end exam and final project.

[Textbook]

Process Control Engineering, Hashimoto, Hasebe, Kano, Asakura book store, isbn{}{4254250312}

[Reference books, etc.]

（Reference books）

Process Control System, Ohshima, CORONA Publishing isbn{}{4339033146}

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

The final term project will be given.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	量子化学概論 Introduction to Quantum Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SATO HIROFUMI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,1time,
,2times,
,2times,
,3times,
,2times,
,2times,
,1time,
,4times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	有機分光学 Spectroscopy for Organic Compounds	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MURAKAMI MASAHIRO Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA Graduate School of Engineering Professor,TANAKA KAZUO Graduate School of Engineering Assistant Professor,HIROSE TAKASHI
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.3	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,2times,
,2times,
,1time,
,8times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	電気化学 Electrochemistry	Affiliated department, Job title,Name	Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Global Environmental Studies Associate Professor,MIYAZAKI KOUHEI Graduate School of Engineering Assistant Professor,宮原　雄人
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Thu.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Fundamental of electrochemical reaction,4times,
Kinetics of electrochemical reaction,4times,
Battery and fuel cell,4times,
Electrolysis,1time,
Corrosion,1time,
Evaluation,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	触媒化学 Catalyst Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,EGUCHI KOUICHI Graduate School of Engineering Professor,TANAKA TSUNEHIRO Graduate School of Engineering Associate Professor,TERAMURA KENTARO Graduate School of Engineering Professor,ABE RYUU
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,2times,
,1time,
,1time,
,2times,
,2times,
,1time,
,1time,
, 1 times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 触媒化学(2)↓↓↓

触媒化学(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

生化学II(2)

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	生化学II Basic Biochemistry II	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,UMEDA MASATO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU Graduate School of Engineering Associate Professor,MASAYUKI MORI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,2times,
,2times,
,2times,
,2times,
,1time,
,4times,

[Class requirement]

None

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

Continue to 生化学II(2)↓↓↓

Numbering code			
Course title <English>	微粒子工学 Fine Particle Technology	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.3	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

From raw materials to finished products, powders#8212particle aggregates#8212are often used in chemical processes. In this course, students will learn about the fundamental properties of particles, characteristics of powders, properties of dispersed particles in a gas (vapor) or liquid phase, particle dynamic behavior analysis, and the generation, separation, and collection of particles.

[Course Goals]

Students will acquire an understanding of the characteristics of particles and powders, and of methods of analyzing the dynamic behavior of fine particles. Students will also foster their abilities in applications and developments involving the manipulation of fine particles, including their generation, separation, and collection.

[Course Schedule and Contents]

Overview of fine-particle engineering (1 class)
Explanation is made of the role of fine engineering in chemical processes, with examples from classical processes and natural phenomena.

Particle properties and measurement (4 classes)
In these lectures, explanation is made regarding the following: particle diameter expression method, particle size distribution and related statistical processing methods, dynamic properties, especially the basic properties of elastic deformation and plastic deformation, physicochemical properties including droplet formation and capillary condensation, etc., electrostatic properties related to electrical charge, optical properties from the relationship between light wavelength and particle diameter, etc., as well as the properties of individual particles, and the characteristics of particle interactions and particle aggregates (assemblies). Measurement methods for these will also be discussed.

Gas (vapor)-phase particle systems (5 classes)
Lectures focus on the basics of microparticle generation via pulverization and nucleation, as well as motion of gas-phase dispersed particles. Explanation is made of analysis methods for basic phenomena such as wall-surface deposition, fine particle aggregation, etc. Using this as a foundation, discussion is then made of various operations, including dispersion, classification, solid-gas separation, materials processing, etc.

Liquid-phase particle systems (4 classes)
Explanation is made of interactions of liquid-phase dispersion particles, and this base is used to discuss unit operations including dispersion, aggregation, filtration, etc. Examples of ordered structure formation based on particle group interactions are explained next. Finally, confirmation is made of the extent that students have understood the contents of this course.

General summary of course (1 class)

Continue to 微粒子工学(2)↓↓↓

微粒子工学(2)

A summary, chiefly focused on dry powder operations.

[Class requirement]

None

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

Evaluation is made on the basis of scores (results) in periodically given tests. Consideration will also be given to reports that may be assigned at any time during the course.

[Textbook]

K. Okuyama, H. Masuda and S. Morooka 『Biryuushi Kougaku ndash Fine particle technology』 (Ohmsha) ISBN:4-274-12900-4

[Reference books, etc.]

(Reference books)

K. Hashimoto, F. Ogino 『Gendai Kagaku Kogaku』 (Sangyo Tosho) ISBN:4-7828-2609-5

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

Students must prepare for classes, and review after classes.

(Others (office hour, etc.))

*Please visit KULASIS to find out about office hours.

※

Numbering code					
Course title <English>	プロセスシステム工学 Process Systems Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Assistant Professor,TONOMURA OSAMU		
Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Thu.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The chemical processes consist of various unit operations. In this course, the concepts and the methods of optimal synthesis,optimal design and production management are described. The mathematical methods for optimization are also explained.

[Course Goals]

This course aims to understand the systematic modelling procedures of the design and operational problems for chemical processes. In addition, it is requested to understand the optimization methods for solving the problems which are formulated as the linear, non-linear or combinatorial programming problem.

[Course Schedule and Contents]

What is PSE?,1time,The concept of process systems engineering is explained.
Modelling of the processes -physical model,1time,The feature of physical models used in the process design and operation problems is explained.
Modelling of the processes - statistical model,1time,The least square method used in constructing the statistical model is explained.
Procedure of process design,1time,The procedure of process design and the solution method using input and output model are explained.
Process design using simulation,1time,The sequential modular approach which is commonly used in the process simulators is explained.
Process synthesis,1time,The combinatorial programming method and multi-step heuristic method which are used in the conceptual design are explained.
Heat exchanger network synthesis,2times,A systematic synthesis method using T-Q diagram is explained for the heat exchanger network synthesis problem.
Production management of chemical processes,1time,The concept of production management including supply chain problem is explained.
Solution procedure using LP,2times,The formulation of the production planning problem as a linear programming problem, and its solution method using the simplex method are explained.
Scheduling problem and BampB method, 2 times,The formulation of the scheduling problem of batch processes as a traveling salesman problem and its solution procedure using the branch and bound method are explained.
Various scheduling problems of batch processes,1time,Various scheduling problems which arise in batch processes and their solution methods are explained.
Evaluation of learning achievement, 1 times,The comprehensive review is executed, and the misunderstanding of the homework is explained.

[Class requirement]

The basic knowledge of chemical engineering such as the unit operation and reaction engineering, and that of differential and integral calculus are requested.

Continue to プロセスシステム工学(2)↓↓↓

プロセスシステム工学(2)

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

Homework assigned in the lectures is treated as 30 points, and the final examination is treated as 70 points of the total score.

[Textbook]

Lecture materials are distributed in the class.

[Reference books, etc.]

(Reference books)

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

(Others (office hour, etc.))

*Please visit KULASIS to find out about office hours.

※

Numbering code					
Course title <English>	プロセス設計 Process Design	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SOTOWA KENICHIRO Faculty of Engineering		
Target year	4th year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Fri.3	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The fundamental skills of designing chemical processes which consist of various unit operations are learned. Then, a conceptual design exercise of a chemical process is executed using the knowledge of chemical engineering and process simulation system.

[Course Goals]

It is requested to understand the way of conceptual design, and to have the skill of designing chemical processes by applying the knowledge of chemical engineering and related field.

[Course Schedule and Contents]

Concept of process design,1time,The concept of process design and the procedure of conceptual design are explained.
Evaluation methods,1time,After explaining the fundamental terms on economical efficiency evaluation, a single-year evaluation method and a multi-year evaluation method are explained.
How to use process simulators,1time,The sequential modular approach that is commonly used in the process simulators is explained. Then, how to use process simulator is explained using the demonstration.
Reality of process design,6times,According to the procedure of process design, some important points and available methods on market research, acquisition of data, process synthesis and equipment design are explained. (Intensive course)
Practice of a chemical process design,17times,The exercise on process design is performed by group consisting of 2 or 3 students.
Oral presentation,4times,The final design of each group is presented at the workshop where all members of the faculty attend.

[Class requirement]

The basic knowledge on chemical engineering such as unit operation is requested.

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

The results are evaluated by the contents of the final report and the oral presentation.

[Textbook]

The reference materials are prepared by teachers.

[Reference books, etc.]

(Reference books)

Continue to プロセス設計(2)↓↓↓

プロセス設計(2)

（Related URLs）

(http://www.cheme.kyoto-u.ac.jp/processdesign/)

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

（Others (office hour, etc.)）

Since the exercise is supervised by faculty members in each laboratory, the registration is restricted to senior students belonging to Chemical Process Engineering Course.

*Please visit KULASIS to find out about office hours.

計算化学工学(2)

data by non-linear least square method.
15. Term-end examination
16. Feedback

[Class requirement]

Excel is to be used. The basic operation of computer and excel is prerequisite.

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

The submission of all homework assignments will be worth 40% of the final grade. The term end exam will be evaluated for the rest of the 60 % of the final grade.

[Textbook]

Text will be prepared by the tutors

[Reference books, etc.]

（Reference books）
Introduced during class

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

Writing program for the chemical engineering problem is assigned as homework every week.

（Others (office hour, etc.)）

The first 30 minutes of the class will be devoted for explaining theory and basic computational scheme needed to solve the assignment of the day. Then, solve the assignment by using the computer.

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	計算化学工学 Computers in Chemical Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOSHIMA MASAHIRO Graduate School of Engineering Associate Professor,NAGAMINE SHINSUKE Graduate School of Engineering Assistant Professor,HIKIMA YUUTA
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.3	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Solving several Chemical Engineering problems with computer language, Visual Basic (VBA) in Excel, the students earn the basic computational skills for engineering calculations. They will be learing how to solve the linear and nonlinear algebraic equations, differential equations, integral and linear and nonlinear least square method for parameter fittings

[Course Goals]

The goals of this course is to write computer programming codes by students themselves for solving the simple Chemical Engineering Problems.

[Course Schedule and Contents]

1. Orientation
After the instruction on how to start the VBA Editor, the students write the programs for basic arithmetic calculation and unit conversion.
2. Algebraic equation
The simple chemical engineering problems that can be formulated by algebraic equations are assigned to solve with VBA.
3-4. Iterative calculation methods
After leaning the successive iteration and Newton iteration, the students write the programs to obtain the solutions of algebraic equations that are not analytically solvable.
5-6. Differential equation
After learning the Euler and RKG methods for solving the differential equations, the students work on the calculation of chemical reactor.
7-8. Numerical integration
After learning computer algorithm like trapezoidal method and Simpson method, the students write programs to integrate numerical data.
9. Partial differential equation
After learning the scheme of approximating the partial differential equation with difference equations, the students numerically solve the heat conduction equation and obtain the time evolution of temperature distribution.
10-11. Matrix calculation
First the programming codes for performing basic matrix calculations is taught. Then, the students learn Gaussian elimination to solve the simultaneous linear equation and develop a computer program to derive a linear regression model from the data.
12-14. Parameter fitting
The students learn the steepest descent method, Newton method and Marquardt method to seek local extremum of multivariable function, and write the program to determine the parameters to fit the model with

Continue to 計算化学工学(2)↓↓↓

※

Numbering code			
Course title <English>	化学実験の安全指針 Safty in Chemistry Laboratory	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI Graduate School of Engineering Senior Lecturer,OOMAE MASASHI Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Associate Professor,SUGASE KENJI Institute for Chemical Research Associate Professor,TOSAKA MASATOSHI Graduate School of Engineering Senior Lecturer,ISHIDA NAOKI
Target year	4th year students or above	Number of credits	1
Course offered year/period	2019/Intensive, First semester		
Day/period	Intensive	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,1time,
,1time,
,1time,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 化学実験の安全指針(2)↓↓↓

化学実験の安全指針(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code					
Course title <English>	物理化学基礎及び演習［工化1］ Physical Chemistry: Fundamentals and Exercises	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KOGA TSUYOSHI		
Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,4times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code					
Course title <English>	化学工学シミュレーション Simulations in Chemical Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,YAMAMOTO RYOICHI Graduate School of Engineering Professor,MIYAHARA MINORU		
Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,1time,
,2times,
,1time,
,2times,
,1time,
,4times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code					
Course title <English>	物理化学基礎及び演習［工化2］ Physical Chemistry: Fundamentals and Exercises	Affiliated department, Job title,Name	Graduate School of Engineering Professor,TANAKA TSUNEHIRO		
Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,4times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学基礎及び演習［工化3］ Physical Chemistry: Fundamentals and Exercises	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIYAHARA MINORU Graduate School of Engineering Associate Professor,TANABE KATSUAKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,4times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学基礎及び演習［工化1］ Exercises in Basic Organic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KONDOU TERUYUKI Graduate School of Engineering Associate Professor,NAGAKI AIICHIROU
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, 2 times,
,3times,
, 1 times,
, 2 times,
,2times,
, 2 times,
, 2 times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学基礎及び演習［工化4］ Physical Chemistry: Fundamentals and Exercises	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,UMEYAMA TOMOKAZU Graduate School of Engineering Associate Professor,SUGASE KENJI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,4times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学基礎及び演習［工化2］ Exercises in Basic Organic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, 2 times,
,3times,
, 1 times,
, 2 times,
,2times,
, 2 times,
, 2 times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学基礎及び演習［工化3］ Exercises in Basic Organic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,HAMACHI ITARU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, 2 times,
,3times,
, 1 times,
, 2 times,
,2times,
, 2 times,
, 2 times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	基礎無機化学［T17，T18］ Basic Inorganic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ABE RYUU Graduate School of Energy Science Associate Professor,TAKAI SHIGEOMI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Fri.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,4times,
,5times,
,5times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学基礎及び演習［工化4］ Exercises in Basic Organic Chemistry	Affiliated department, Job title,Name	Institute for Chemical Research Professor,YAMAGO SHIGERU Institute for Chemical Research Assistant Professor,KAYAHARA EIICHI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, 2 times,
,3times,
, 1 times,
, 2 times,
,2times,
, 2 times,
, 2 times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	基礎無機化学［T19，T20］ Basic Inorganic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Fri.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,4times,
,5times,
,5times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	基礎無機化学［T21，T22］ Basic Inorganic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,FUJITA KOUJI Institute for Liberal Arts and Sciences Professor,TANAKA KATSUHISA
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Fri.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,4times,
,5times,
,5times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

化学プロセス工学基礎［T17，T18］(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学プロセス工学基礎［T17，T18］ Fundamental Chemical Process Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,YAMAMOTO RYOICHI Graduate School of Engineering Associate Professor,MAKI TAISUKE
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Thu.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,2times,
,1time,
,1time,
,0.5times,
,1time,
,1.5times,
,1time,
,2times,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 化学プロセス工学基礎［T17，T18］(2)↓↓↓

Numbering code			
Course title <English>	化学プロセス工学基礎［T19，T20］ Fundamental Chemical Process Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Senior Lecturer,ASHIDA RIYUUICHI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Thu.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Transport phenomenon of materials, energy, and momentum are important not only in chemical processes but also in environmental problems and energy problems which include diffusion of pollutants and efficient utilization of heat. In this course, beginning with material and energy balances, momentum transport, energy transport, and material transport are explained. As well, fundamentals of chemical reaction engineering which aims to analyze and design chemical reactors are lectured. Categorization of reactor operation and shapes of reactors is explained from engineering viewpoint and methods for formulating reaction rate equations from experimental data and for designing reactors are then explained.

[Course Goals]

To learn fundamentals of chemical process engineering particularly transport phenomena and chemical reaction engineering.

[Course Schedule and Contents]

Weeks 1 and 2: Fluid dynamics (momentum transport)--- Basic concepts of transport phenomena, momentum transport in fluids as well as Newton's law of viscosity, laminar flow of Newtonian fluid, turbulent flow and friction factor, and macroscopic flow and application of balance equation to actual processes are lectured.

Weeks 3 and 4: Heat transfer (energy transport)--- Types of heat transfer, heat conduction and Fourier's law, heat transfer at fluid--solid interface and heat transfer coefficient, convective heat transfer, and principles of heat exchanger are lectured.

Weeks 5 and 6: Diffusion (material transport)--- Diffusion and Fick's laws, analogy between momentum transport, energy transport, and material transport, equimolar counter diffusion and one-directional diffusion, and application to diffusion problems are lectured.

Week 7: Review of transport phenomena--- Comprehensive lecture of fluid dynamics, heat transfer, and diffusion which were taught previous weeks is given.

Week 8: Confirmation of understanding of transport phenomena--- Intermediate examination on transport phenomena as practice.

Week 9: Classification of chemical reactions and chemical reactors--- Basic concept of chemical reaction engineering is lectured and categorization of reactions and reactors from engineering viewpoint is explained.

Weeks 9 and 10: Reaction rate equation--- Definition of reaction rate and its dependency on temperature are explained. Steady-state approximation and partial equilibrium approximation fro formulation of overall

Continue to 化学プロセス工学基礎［T19，T20］(2)↓↓↓

reaction are lectured.

Weeks 10 and 11: Fundamental equations of designing and operating reactors--- Stoichiometry during reaction and kinetic balance equations of batch reactor, continuous tank reactor, and tubular reactor are explained.

Week 12: Kinetic analysis of simple reaction--- Measuring data in experiments using batch reactor, tubular reactor, or continuous tank reactor, analyzing those data, and formulating reaction rate as a function of concentrations and temperature are explained.

Weeks 13 and 14: Design and operation of reactors--- Design and operation of reactors are taught and exercised.

Week 15: Comprehensive lecture on chemical reaction engineering which were lectured in previous weeks is given.

[Class requirement]

None

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

Absolute evaluation of intermediate and final examinations. Take-home assignments and in-class quizzes are imposed and evaluated if necessary.

[Textbook]

K. Hashimoto and F. Ogino ed. 『Gendai Kagakukogaku (2001)』 （Sangyo Tosho）ISBN:4782826095

[Reference books, etc.]

（Reference books）

F. Ogino 『Ido Gensho 』 （Sangyo Tosho）ISBN:478282520X
R. Bird, W. Stewart and E. Lightfoot 『Transport Phenomena (2nd Ed.)』 （Wiley）ISBN:9780470115398
K. Hashimoto 『Han'no Kogaku (revised)』 （Baifukan）ISBN:4563045187

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

Read through a corresponding part of the textbooks before the lecture. Assignments are usually taken from the textbooks.

（Others (office hour, etc.) ）

All registered students are divide into 3 classes. The 3 classes run separately though the contents are shared. Fundamental knowledge on ordinary differential equations is needed. Be sure to take two examinations on the former part (transport phenomena) and the latter part (chemical reaction engineering).

*Please visit KULASIS to find out about office hours.

Continue to 化学プロセス工学基礎［T19，T20］(3)↓↓↓

※

Numbering code			
Course title <English>	化学プロセス工学基礎［T21，T22］ Fundamental Chemical Process Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIYAHARA MINORU Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Thu.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,2times,
,1time,
,1time,
,0.5times,
,1time,
,1.5times,
,1time,
,2times,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

Continue to 化学プロセス工学基礎［T21，T22］(2)↓↓↓

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.) ）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学Ⅰ（創成化学） Organic Chemistry I (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,NAKAO YOSHIAKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,4times,
,3times,
,3times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	無機化学（創成化学） Inorganic Chemistry (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,SHIMOTSUMA YASUHIKO
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,4times,
,4times,
, 1 times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学Ⅰ（創成化学） Physical Chemistry I (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NISHIDA KOUJI Graduate School of Engineering Professor,KOGA TSUYOSHI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,3times,
,3times,
,3times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	分析化学（創成化学） Analytical Chemistry (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOTSUKA KOUJI Graduate School of Engineering Associate Professor,OYAMA MUNETAKA Graduate School of Engineering Associate Professor,KUBO TAKUYA
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Fri.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Principle of Chemical Equilibrium,2times,
Acid-Base Equilibrium,4times,
Complex-Formation Equilibrium,4times,
Oxidation-Redcution Equilibrium,4times,
,1time,

[Class requirement]

None

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

[Textbook]

Daniel C. Harris: Quantitative Chemical Analysis (W.H. Freeman, 9th Ed., 2016) isbn{}{9781464135385}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学基礎Ⅰ（創成化学） Elements of Polymer Chemistry I (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NISHIDA KOUJI Graduate School of Engineering Associate Professor,MATSUOKA HIDEKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Thu.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,1time,
,2times,
,1time,
,1time,
,1time,
,2times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	生体関連物質化学（創成化学） Biorelated Material Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KIMURA SHIYUNSAKU Institute for Frontier Life and Medical Sciences Professor,TABATA YASUHIKO Graduate School of Engineering Senior Lecturer,OOMAE MASASHI Institute for Frontier Life and Medical Sciences Assistant Professor,JO JUNICHIRO
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, **4** times,
,4times,
,4times,
,3times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学II（創成化学） Organic Chemistry II (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,3times,
,3times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学II（創成化学） Physical Chemistry II (Frontier Chemistry)	Affiliated department, Job title,Name	Institute for Chemical Research Associate Professor,OONO KOUJI Institute for Chemical Research Professor,TSUJII YOSHINOBU
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,2times,
,2times,
,4times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学基礎II（創成化学） Elements of Polymer Chemistry II (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,HORINAKA JIYUNICHI Graduate School of Engineering Associate Professor,TERASHIMA TAKAYA
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,3times,
,3times,
,4times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	機器分析化学（創成化学） Instrumental Analytical Chemistry (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOTSUKA KOUJI Graduate School of Engineering Associate Professor,OYAMA MUNETAKA Graduate School of Engineering Associate Professor,KUBO TAKUYA
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Fri.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Chromatography,4times,
Spectroscopy,5times,
Electrochemical Analysis,5times,
,1time,

[Class requirement]

None

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

[Textbook]

Daniel C. Harris: Quantitative Chemical Analysis (W.H. Freeman, 9th Ed., 2016) isbn{}{9781464135385}

[Reference books, etc.]

（Reference books）

Douglas A. Skoog, F. James Holler, Stanley R. Crouch :Principles of Instrumental Analysis(Cengage Learning, 7th Ed., 2017) isbn{}{9781305577213}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	統計熱力学入門（創成化学） Introduction to Statistical Thermodynamics (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,IDA DAICHI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,3times,
,3times,
,3times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学III（創成化学） Organic Chemistry III (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA Graduate School of Engineering Associate Professor,YOSHIHIRO SASAKI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Tue.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,2times,
,2times,
,2times,
,4times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code					
Course title <English>	物理化学III（創成化学） Physical Chemistry III (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOKITA HIDEO		
Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

In Physical Chemistry III (frontier chemistry), lectures will focus on quantum chemstry, which is one of the core subjects in physical chemistry as well as thermodynamics and statistical thermodynamics: quantum chemistry describe the dynamics and properies of microscopic systems such as electrons and molecules, thermodynamics provides systematic description of macroscopic properties and characteristics, and statistical thermodynamics makes links between microscopic and macroscopic properties. The lectures will also focus on how quantum theory serves as a basis for understanding electron configuration in atoms, chemical bonds, molecular structure, and various spectroscopic properties.

[Course Goals]

Students will understand quantum theory systematically, which provides the fundamental laws of the molecular world. Students will also become able to explain, on the basis of quantum theory, electron configuration in atoms, chemical bonds, molecular structures, and various spectroscopic properites.

[Course Schedule and Contents]

(1) Quantum theory (5 classes)
・ Origins of quantum mechanics and microscopic system dynamics
・ Quantum-mechanical principles
・ Translational motion, vibrational motion
・ Rotational motion

(2) Atomic structure and atomic spectra (2 classes)
・ Structure and spectra of the hydrogen atom
・ Structure and complex atomic spectra of multielectron atoms

(3) Molecular structure (2 classes)
・ Valence bond method, molecular orbital method
・ Polyatomic molecular system orbitals

(4) Molecular spectroscopy 1 (2 classes)
・ Rotational spectrum
・ Vibrational spectrum

(5) Molecular spectroscopy 2 (1 class)
・ Electron transition

(6) Molecular spectroscopy 3 (1 class)
・ Magnetic resonance

Continue to 物理化学III（創成化学）(2)↓↓↓

物理化学III（創成化学）(3)

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

Lectures will proceed on the assumption that students have read carefully and thoroughly assigned textbook pages before each class period. Therefore, students should be sure to perform such study before and after each class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

物理化学III（創成化学）(2)

(7) Intermolecular interactions (1 class)
・ Electrical properties
・ Intermolecular interactions

Final examination/ Confirmation of extent of student learning (1 class)

Feedback (1 class)

[Class requirement]

Prerequisites for this course are completion of the following courses: Fundamentals of Physical Chemistry and Practical Exercises, Physical Chemistry I (Frontier Chemistry), and Physical Chemistry II (Frontier Chemistry).

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

Grading method
Final examination scores (80%) and class attendance and participation (20%)
The “class attendance and participation” evaluation will include attendance records of students and evaluations of short reports.

Grading standard
The following grades are given in accordance with the goal-achievement levels of each individual student:
A+: Course goals have been accomplished at an extremely high level, from all perspectives.
A: Course goals have been accomplished at a high level, from all perspectives.
B: Course goals have been accomplished, from all perspectives.
C: Confirmation can be made, from a majority of perspectives, of effects of student learning, and course goals have been accomplished to a certain extent.
D: While course goals have been accomplished to a certain extent, further effort by the student is desirable.
F: No confirmation can be made of effects of student learning, and it is difficult to say that a student has accomplished the goals of this class.

[Textbook]

Peter Atkins, Julio de Paula 著, 中野元裕・上田貴洋・奥村光隆・北河康隆 訳 『アトキンス「物理化学」第１０版（上）』（東京化学同人）ISBN:978-4-8079-0908-7（アトキンス「物理化学」第８版（上）でも構いません）
Peter Atkins, Julio de Paula 著, 中野元裕・上田貴洋・奥村光隆・北河康隆 訳 『アトキンス「物理化学」第１０版（下）』（東京化学同人）ISBN:978-4-8079-0909-4（アトキンス「物理化学」第８版（下）でも構いません）

[Reference books, etc.]

（Reference books）
To be introduced during the course

Continue to 物理化学III（創成化学）(3)↓↓↓

※

Numbering code					
Course title <English>	最先端機器分析（創成化学） Advanced Instrumental Analysis (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOTSUKA KOUJI Graduate School of Engineering Associate Professor,OYAMA MUNETAKA Graduate School of Engineering Associate Professor,KUBO TAKUYA		
Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Fri.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

High-performance Separation Analysis,4times,
Electrochemical Analysis, Advanced,4times,
Spectroscopic Analysis 1,1time,
Spectroscopic Analysis 2,4times,
Topics,1time,
,1time,

[Class requirement]

None

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

[Textbook]

Daniel C. Harris: Quantitative Chemical Analysis (W.H. Freeman, 9th Ed., 2016) isbn{}{9781464135385}

[Reference books, etc.]

（Reference books）
Douglas A. Skoog, F. James Holler, Stanley R. Crouch :Principles of Instrumental Analysis(Cengage Learning, 7th Ed., 2017) isbn{}{9781305577213}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学のフロンティア（創成化学） Frontier Chemistry (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIURA KIYOTAKA Faculty of Engineering
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Fri.4	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Advanced research being performed in frontier chemistry research labs will be explained in an easy-to-understand way by researchers themselves. This is a concentrated course: Two classes will be held one after the other on Friday afternoons at 13:00-14:30 and 14:45-16:15, for a total of seven class days. Course dates are posted separately elsewhere.

[Course Goals]

Students will gain knowledge of frontier research as currently practiced in representative chemistry research areas, as well as of likely future trends. Students will also understand the role that chemistry plays in society.

[Course Schedule and Contents]

Frontlines of polymer properties (2 classes)
As macromolecules form a variety of molecular assembly structures, they display superior properties. In these lectures, an overview explanation is provided on how block copolymers and graft copolymers form, via self-organization, regular micro-phase separated structures on nanometer orders. These nano-patterns are then used in the development of devices and new materials.

Frontlines of polymer synthesis (2 classes)
An overview explanation is provided of basic chain polymerization functions, methods of precise synthesis of macromolecules via chain polymerization, and the characteristics of polymers thus precisely synthesized.

Frontlines of macromolecular design (2 classes)
Chemistry for the rational design and synthesis of macromolecules is indispensable to activities that aim to proactively grant new functions to polymers. Students will gain a deeper understanding of the fundamentals of living radical polymerization, which has undergone remarkable developments in recent times, and surface-graft polymerization; an overview of applications and related items will also be presented from the viewpoint of material design, especially applications in surface graft polymerization.

Frontlines of polymer characterization (2 classes)
An overview explanation is provided of light scattering in polymer solutions and of methods for determining molecular parameters from intrinsic viscosity measurement. Also discussed are application examples for each type of macromolecule (polymer).

Frontlines of organic chemistry and analytical chemistry (2 classes)
Fine organic synthesis using organometallic compounds has become the most powerful tool of molecular architecture. An overview is made of the theories of fine organic synthesis, and concrete advanced research cases are introduced. Micro- and nanoscale high-performance separation and analysis techniques are introduced to showcase the frontlines of novel topics.

Continue to 化学のフロンティア（創成化学）(2)↓↓↓

※

Numbering code			
Course title <English>	化学生物学 Chemical Biology	Affiliated department, Job title,Name	Institute for Frontier Life and Medical Sciences Professor,EIRAKU GENJI Institute for Frontier Life and Medical Sciences Associate Professor,OHGUSHI MASATOSHI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Thu.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

It is important in the field of life science to understand biochemistry and biological medicine in terms of organic material chemistry. The way to think and view the biological system and bioprocess at the molecular level can make clear the academic knowledge of life science and contribute to the development of engineering-medicine-pharmacy interdisciplinary research area. In this lecture, proteins, polysaccharides, and lipids of bio-related substances as well as cells, cell membrane, extracellular matrix of biological system are explained in terms of chemical biology. As a representative of engineering-medicine-pharmacy interdisciplinary research area, drug delivery system (DDS) and regenerative medicine are introduced. In addition, some topics in the field of life science, including stem cells, body defense and immunology, and endocrine disruptor, are also covered.

[Course Goals]

The objective of the lecture is to obtain the fundamental knowledge of proteins, polysaccharides, lipids, cells, and extracellular matrix and understand stem cells, body defense, DDS, regenerative medicine, and endocrine disruptor of life science application.

[Course Schedule and Contents]

Proteins and enzymes,2times,Structure and function of proteins and enzymes
Polysaccharides and lipids,1time,Structure and function of polysaccharides and lipids
Cell and cell membrane,1time,Structure and function of cells and membrane transportation
Signal transduction,1time,Signal transduction at cell membrane
Energy conversion,1time,Oxidative phosphorylation to generate ATP
Cytoskeleton,1time,Cellular biomechanics and biochemistry of cytoskeleton
Body defense and immunology,1time,System and function of body defense and immunology
Stem cells,1time,System, function, and medical application of stem cells
Cell and extracellular matrix,1time,Structure and function of extracellular matrix
Regenerative medicine and material science,2times,Overview of regenerative medicine based on material science
Drug delivery system (DDS),1time,Overview of DDS based on material science
Endocrine disruptor,1time,Overview of endocrine disruptor based on material science
Achievement evaluation,1time,Credit evaluation based on the understanding level of lecture contents

[Class requirement]

None

Continue to 化学生物学(2)↓↓↓

化学のフロンティア（創成化学）(2)

Frontlines of inorganic materials chemistry (2 classes)
Discussion will be made of the synthesis and function of novel inorganic materials synthesis for applications involving spin electronics and photonics materials.

Frontlines of polymer materials chemistry (2 classes)
Explanation will be made of recent issues associated with the characteristics and properties of such things as elastomers and polymer gels. Lectures discuss the flow of development from supramolecular assembly to supramolecular organization, trends in molecular architecture such as catenane and rotaxane, and the development of nanomaterials.

Feedback (1 class)
Evaluation is made of the extent of learning achieved in the course overall, and in regards to the degree that students have achieved course goals.

[Class requirement]

Students are recommended to have finished fundamental courses in organic chemistry, physical chemistry, inorganic chemistry, analytical chemistry, and polymer chemistry.

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

Grades will be determined based on an overall evaluation of attendance and scores (results) on reports.

[Textbook]

No textbook will be used. Materials and PowerPoint presentations will be distributed and/or used during classes.

[Reference books, etc.]

（Reference books）

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

Assignments and individual reports will be appropriately instructed during classes.

（Others (office hour, etc.)）

Course contents may be changed as necessary.

*Please visit KULASIS to find out about office hours.

化学生物学(2)

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

The credit is judged by the scheduled examination and the attendant rate.

[Textbook]

[Reference books, etc.]

（Reference books）

Fundamentals of Biochemistry: Life at the Molecular Level；Wiley isbn{}{9780470547847}、
Molecular biology of the Cell ；Garland Science isbn{}{9780815344322}、
ますます重要になる細胞周辺環境（細胞ニッチ）の最新科学技術；株式会社メディカルドゥ isbn{}{9784944157846}、
Immunology；Saunders isbn{}{9780323080583}、
生物薬剤学；株式会社南江堂 isbn{}{9784524403059}、
絵で見てわかるナノDDS；**株式会社メディカルドゥ** isbn{}{9784944157884}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学Ⅰ Polymer Chemistry I	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOUCHI MAKOTO
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Based on the courses quotFundamental Polymer Science I and IIquot (covering polycondensation and radical polymerization), this course is to discuss the concepts and the characteristics of coordination, stereospecific, ionic (anionic and cationic), ring-opening, and living polymerizations. Examples are provided for initiators, monomers, reaction mechanism, polymerization intermediates, and produced polymers.

[Course Goals]

To discuss fundamental aspects of polymer chemistry, particularly the fundamental nature of polymers and their synthesis (polymerization reactions).

[Course Schedule and Contents]

Coordination Polymerization,2times,To discuss: The fundamentals of coordination and Ziegler-Natta polymerizations, including ring-opening metathesis polymerization, and the relation between catalyst design and polymerization mechanism.
Stereospecific Polymerization,2times,To discuss: The fundamentals of stereospecific polymerization, polymer characterization therein, and the relation between polymer steric structure and polymerization mechanism.
Study Achievement Test (1),1time,To examine as quotfeed-backquot: The achievement of studying in the subjects that have already been discussed (coordination and stereospecific polymerizations).
Anionic Polymerization,3times,To discuss: The fundamental of anionic polymerization, including initiators, monomers, their structurendashreactivity relationships, elementary reactions, kinetics. and reaction mechanisms.
Cationic Polymerization,3times,To discuss: The fundamental of cationic polymerization, including initiators, monomers, their structurendashreactivity relationships, elementary reactions, kinetics. and reaction mechanisms.
Ring-Opening Polymerization,1time,To discuss: The fundamental of ring-opening polymerization, including initiators, monomers, their structurendashreactivity relationships, elementary reactions, kinetics. and reaction mechanisms.
Living Polymerization,2times,To discuss: The definition and examples of quotlivingquot polymerization, including initiators, catalysts, monomers, their structure-reactivity relationships, elementary reactions, kinetics, and reaction mechanisms
Study Achievement Test (2),1time,To examine as quotfeed-backquot: The achievement of studying in the subjects that have already been discussed (ionic and living polymerizations).

Continue to 高分子化学Ⅰ(2)↓↓↓

※

Numbering code			
Course title <English>	化学数学（創成化学） Mathematics of Chemistry(Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,TAKIGAWA TOSHIKAZU Graduate School of Engineering Professor,NAKAMURA YOU
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Tue.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,1time,
,1time,
,1time,
,1time,
,2times,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 化学数学（創成化学）(2)↓↓↓

高分子化学Ⅰ(2)

[Class requirement]

Fundamental Polymer Science I (2nd year, 2nd term) and Fundamental Polymer Science II (3rd year, 1st term)

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

Written Examination

[Textbook]

None in particular. PDF files of slides that are to be shown at the course lectures will be uploaded into the course website, and it is strongly recommended for students to download these materials for review and self-learning.

[Reference books, etc.]

（Reference books）

quotFundamentals in Polymer Sciencequot, Tokyo Kagaku Dojin: isbn{}{9784807906352}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

化学数学（創成化学）(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	錯体化学（創成化学） Coordination Chemistry (Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,FUJITA KOUJI Institute for Liberal Arts and Sciences Professor,TANAKA KATSUHISA
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,3times,
,2times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	創成化学実験Ⅰ（創成化学） Frontier Chemistry Laboratory I(Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Faculty of Engineering 創成化学実験関連教員
Target year	3rd year students or above	Number of credits	7
Course offered year/period	2019/First semester		
Day/period	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,6times,
,6times,
,12times,
,9times,
,3times,
,9times,
,15times,
,6times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学II Polymer Chemistry II	Affiliated department, Job title,Name	Graduate School of Engineering Professor,TAKENAKA MIKIHITO Institute for Chemical Research Assistant Professor,OGAWA HIROKI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Fri.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

Mastering at least the minimum knowledge of polymer physics necessary for starting research in polymer field

[Course Schedule and Contents]

polymer structure and characteristic property,3times,Definition of polymer, polymer characteristics, kinds of polymer, molecular structure, shape of a single-chain and its variety, molecular weight and molecular weight distribution will be discussed.
,4times,
,4times,
,3times,
,1time,

[Class requirement]

None

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

Grading

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	創成化学実験Ⅱ（創成化学） Frontier Chemistry Laboratory II(Frontier Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Faculty of Engineering 創成化学実験関連教員
Target year	3rd year students or above	Number of credits	7
Course offered year/period	2019/Second semester		
Day/period	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,6times,
,12times,
,9times,
,3times,
,9times,
,15times,
,6times,
,6times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	科学英語（創成化学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Part-time Lecturer,BOLSTAD, Francesco
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.3	Class style	Lecture
Language	English		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,４times,
,４times,
,５times,

[Class requirement]

None

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

[Textbook]

None

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code	U-ENG27 27200 LJ60		
Course title <English>	物理化学Ⅰa（工業基礎化学） Physical Chemistry Ia (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,TANAKA TSUNEHIRO Graduate School of Engineering Associate Professor,TERAMURA KENTARO
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

化学反応の理解に必要な熱力学及び化学反応速度に関する基礎的な内容を講義する。

[Course Goals]

物理化学基礎及び演習に続く内容で，応用熱力学及び反応速度論を使いこなすための能力を養う。

[Course Schedule and Contents]

以下の各項目について講義する。各項目では，受講者の理解の程度を確認しながら，【 】で示した回数を充てる。各項目・小項目の講義の順序は固定したものではなく，講義担当者の講義方針と受講者の背景や理解の状況に応じて，講義担当者が適切に決定する。

（１）相【３回】
　　相の考え方，相平衡，相律，化学ポテンシャル
（２）溶液の熱力学【３回】
　　部分モル量，活量，浸透圧と蒸気圧
（３）化学平衡【３回】
　　動的平衡，標準自由エンタルピー，非理想系の平衡，フガシティー
（４）化学反応速度論【５回】
　　化学反応速度，反応速度式，速度定数と平衡定数，衝突理論，活性複合体理論，連鎖反応，触媒反応
（５）学習到達度の確認【１回】
（６）フィードバック【１回】

[Class requirement]

前期配当の物理化学基礎及び演習の知識を必要とする。

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

平常点と定期試験を合わせて評価する。

[Textbook]

Not used

[Reference books, etc.]

（Reference books）

W. J. Moore著，藤代亮一訳『ムーア「物理化学（上）」第４版』（東京化学同人）ISBN:ISBN4-

Continue to 物理化学Ⅰa（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	科学英語（創成化学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Part-time Lecturer,BOLSTAD, Francesco
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.4	Class style	Lecture
Language	English		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

物理化学Ⅰa（工業基礎化学）(2)

8079-0002-1（第６，７，８，９章）
Peter Atkins・Julio de Paula著，中野元裕・上田貴洋・奥村光隆・北河康隆訳『アトキンス「物理化学（上）」第１０版』（東京化学同人）ISBN:ISBN978-4-8079-0908-7（第４，５，６章）
Peter Atkins・Julio de Paula著，中野元裕・上田貴洋・奥村光隆・北河康隆訳『アトキンス「物理化学（下）」第１０版』（東京化学同人）ISBN:ISBN978-4-8079-0909-4（第２０，２１章）

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

講義した内容を復習して，期末試験に臨むこと。

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学Ⅰb（工業基礎化学） Physical Chemistry Ib (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SEKI SYUHEI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Thu.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Repetition of thinking again and again is only the way to master the Physico-Chemical concepts; there is no shortcuts to learn them in principle. This is also the case to learn the concepts in Solid State Physics. Once you master the concepts into yourselves, you will never forget and lose them. It will take a bit longer time to master them, but everybody are able to master them by the “simple repetition of thinking”, however never acquire the concepts if stop the thinking. Mastering the concepts will allow you to judge/make an immediate decision on critical factors controlling data/phenomena in our natural systems, or allow you to interpret the factors changing the systems. This is the “Master of (Physico-Chemical) Concepts”. Statistical mechanics and thermodynamics, the major target of the present class, are representative of Physical Chemistry due to their versatility to reproduce our practical systems.

The major aim of the present class is:
To understand macroscopic phenomena in our practical/natural system quantitatively by an use of Physico-Chemical concepts, particularly on statistical physics.

In the first half of this class, we start to discuss on quantitative definition of “entropy” based on the simple statistical mechanics, away from the hysterical/conventional definition of entropy in line of classical thermodynamics. The discussions on “statistical entropy” will be extended to represent a variety of intensive variables of some practical system via the concept of “Ensemble”, followed by the discussions on the feasibility of statistical mechanics for understanding the physical properties of matters/chemical reactions.

[Course Goals]

Targets:
1) Definition of entropy by statistical mechanics and understanding the concepts of entropy via mathematical derivations
2) Requisites for statistical mechanical approach to the systems
3) Concepts of ensembles: the extension to the real systems
4) Derivation of a series of intensive variables representative of systems
5) Feasibility of the above concepts to understand the practical systems, spectroscopic techniques, physical properties of matters, and practical chemical reactions.

Finally we approach to the limitations of the classical statistical mechanics, leading to the dawn of quantum mechanical treatment for the thermodynamic bodies: unlikely to the case for the requirements of the treatments in atomic structures/blackbody radiations. We finally discuss on the gap between Maxwell-Boltzmann systems and Fermi-Dirac/Bose-Einstein statistical systems.

Continue to 物理化学Ⅰb（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	無機化学Ⅰ（工業基礎化学）［工化1・工化3］ Inorganic Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO Institute of Advanced Energy Professor,NOHIRA TOSHIYUKI Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Program-Specific Associate Professor,HOSOKAWA SABUROU Graduate School of Global Environmental Studies Associate Professor,FUKUTSUKA TOMOKAZU Graduate School of Engineering Professor,ABE RYUU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

In quotInorganic Chemistry Iquot, following four topics will be explained: 1) Acids and bases of inorganic compounds 2) Oxidation and reduction 3) Concept of group theory, which is necessary for the understanding of molecular structures 4) Fundamentals of d-block coordination compounds

[Course Goals]

Acids and bases, oxidation and reduction, a group theory, and coordination compounds will be understood for Inorganic chemistry II at 3rd grade and Electrochemistry at 4th grade.

[Course Schedule and Contents]

Asids and Bases,4times,Bronstead acids and bases and the Lewis acids and bases will be described. Hard and Soft Acids and Bases (HSAB) theory by Peason will be explained. Finally, solvent parameters which can evaluate the degree of intensities of acids and bases will be described.
Oxidation and Reduction,4times,Oxidation and Reduction will be explained mainly by using electrochemistry. In particular, stand ard potentials will be explained in detail. By using the potentials, oxidation and reduction reactions will be explained.
Molecular Symmetry,4times,Based on the molecular shapes, point groups can be determined. By using point groups, various physical phenomena of molecules will be described.
Coordination compounds,2times,Coordination compounds based on metal ions of Lewis acids and ligands of Lewis bases will be described and their geometrical structures will be explained.
Evaluation,1time,Evaluaion

[Class requirement]

Based on the understanding of quotFundamental Inorganic Chemistryquot, lectures will be done.

Continue to 無機化学Ⅰ（工業基礎化学）［工化1・工化3］(2)↓↓↓

[Course Schedule and Contents]

1. Principles of Statistical Mechanics and Entropy; mathematical backgrounds
2. Definition of Entropy: Approaches from statistical mechanics and conventional thermodynamics
3. Boltzmann Principles: Historical reviews starting from the discussions by Clausius
4. Translational Motion of Atoms/Molecules
5. Phase Transitions revisited by Statistical Mechanical Approaches: Heat Capacity of Matters
6. Distribution of Molecular Motions in Gases: Partition Functions
7. Canonical Ensembles: Partition Functions
8. A Varieties of Intensive Variables: in relation to macroscopic thermodynamic systems
9. Mid-Term Exam
10. Entropy Elasticity
11. Brownian Motions and the Collision Theory of Particles
12. Arrhenius Equation and Law
13. Eyring Equations and the Transition State Theory
14. Limitations of Classical Statistical Mechanics towards Quantum Statistical Mechanics

[Class requirement]

None

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

Scores will be made by the following dual ways (finalized by the better one)

1) Active participation + midterm examination + final examination in total
2) Final examination only

No makeup exam after the final examination.

[Textbook]

Walter J. Moore 『Physical Chemistry』 (Longman Publishing Group) ISBN:978-0582442344

[Reference books, etc.]

（Reference books）
Richard P. Feynman 『Feynman Lectures on Physics Vol1』 ISBN:978-0465024933

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

Think quantitatively and calculate anything.

（Others (office hour, etc.)）

Welcome not only the questions during/at the end of classes, but also the question papers.

*Please visit KULASIS to find out about office hours.

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

Grading is based on the examination held at the end of the semester. The attendance rate and the reports submitted during the course may be counted in evaluation.

[Textbook]

Inorganic Chemistry (6th edition) M.Weller、T.Overton、J.Rourke、F.Armstrong(2014) ISBN 9780199641826 isbn{}{9780199641826}

[Reference books, etc.]

（Reference books）
Supplemental explanation will be delivered at the first class.

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

（Others (office hour, etc.)）

Before the class, each topic should be prepared. At every class, quizes will be given and the answers for them should be submitted at the next class.

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	無機化学Ⅰ（工業基礎化学）［工化2・工化4］ Inorganic Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO Institute of Advanced Energy Professor,NOHIRA TOSHIYUKI Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Program-Specific Associate Professor,HOSOKAWA SABUROU Graduate School of Global Environmental Studies Associate Professor,FUKUTSUKA TOMOKAZU Graduate School of Engineering Professor,ABE RYUU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

In quotInorganic Chemistry Iquot, following four topics will be explained: 1) Acids and bases of inorganic compounds 2) Oxidation and reduction 3) Concept of group theory, which is necessary for the understanding of molecular structures 4) Fundamentals of d-block coordination compounds

[Course Goals]

Acids and bases, oxidation and reduction, a group theory, and coordination compounds will be understood for Inorganic chemistry II at 3rd grade and Electrochemistry at 4th grade.

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

Based on the understanding of quotFundamental Inorganic Chemistryquot, lectures will be done.

Continue to 無機化学Ⅰ（工業基礎化学）［工化2・工化4］(2)↓↓↓

※

Numbering code			
Course title <English>	分析化学Ⅰ（工業基礎化学）［工化1・工化3］ Analytical Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO Institute of Advanced Energy Professor,NOHIRA TOSHIYUKI Institute for Integrated Radiation and Nuclear Science Associate Professor,OKI YUUICHI Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,NISHI NAOYA Graduate School of Engineering Associate Professor,KOBAYASHI YOUJI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The solution equilibria that are important not only for introductory analytical chemistry but also for the fundamentals of chemistry, in general, such as acid-base equilibrium, complex formation, precipitation, and oxidation-reduction equilibrium, are the subjects of this course.

[Course Goals]

Not only the understanding of the basics of solution equilibria and the capability of solving related problems, but the appreciation of the relationship of the solution equilibria with other disciplines of chemistry and science, in general, will be targeted.

[Course Schedule and Contents]

Intriduction to chemical equilibrium,2times,
Acid-base equilibrium,5times,
Precipitation equilibrium,1time,
Complexation equilibrium,2times,
Oxidation-recduction equilibrium,4times,
Evaluation,1time,

[Class requirement]

None

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

Grading is based on the examination held at the end of the semester. The attendance rate and the reports submitted during the course may be counted in evaluation.

Continue to 分析化学Ⅰ（工業基礎化学）［工化1・工化3］(2)↓↓↓

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

Grading is based on the examination held at the end of the semester. The attendance rate and the reports submitted during the course may be counted in evaluation.

[Textbook]

Inorganic Chemistry (6th edition) M.Weller、T.Overton、J.Rourke、F.Armstrong(2014) ISBN 9780199641826 isbn{}{9780199641826}

[Reference books, etc.]

（Reference books）

Supplemental explanation will be delivered at the first class.

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

（Others (office hour, etc.)）

Before the class, each topic should be prepared. At every class, quizes will be given and the answers for them should be submitted at the next class.

*Please visit KULASIS to find out about office hours.

[Textbook]

Daniel C. Harris, Quantitative Chemical Analysis, 9th ed., Freeman (2016) isbn{}{9781464135385}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	分析化学Ⅰ（工業基礎化学）［工化2・工化4］ Analytical Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO Institute of Advanced Energy Professor,NOHIRA TOSHIYUKI Institute for Integrated Radiation and Nuclear Science Associate Professor,OKI YUUICHI Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,NISHI NAOYA Graduate School of Engineering Associate Professor,KOBAYASHI YOUJI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The solution equilibria that are important not only for introductory analytical chemistry but also for the fundamentals of chemistry, in general, such as acid-base equilibrium, complex formation, precipitation, and oxidation-reduction equilibrium, are the subjects of this course.

[Course Goals]

Not only the understanding of the basics of solution equilibria and the capability of solving related problems, but the appreciation of the relationship of the solution equilibria with other disciplines of chemistry and science, in general, will be targeted.

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

Continue to 分析化学Ⅰ（工業基礎化学）［工化2・工化4］(2)↓↓↓

※

Numbering code			
Course title <English>	有機化学Ⅰ（工業基礎化学）［工化1・工化3］ Organic Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOE KOUICHI Graduate School of Engineering Associate Professor,MIURA TOMOYA Institute for Chemical Research Professor,NAKAMURA MASAHARU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Structure of Molecules and Organic Reactions (Chs 4 and 5),1time,
Nucleophilic Addition to the Carbonyl Group (Ch 6),2times,
Delocalization and Conjugation (Ch 7),2times,
Acidity, Basicity, and pKa (Ch 8),2times,
Using Organometallic Reagents to Make C-C Bonds (Ch 9),1time,
Nucleophilic Substitution at the Carbonyl Group (Ch 10),2times,
Nucleophilic Substitution at C=O with Loss of Carbonyl Oxygen (Ch 11),2times,
Determining Organic Structures Using Spectroscopies (Chs 3 and 13),2times,
assessing a student#039s level of attainment,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

分析化学Ⅰ（工業基礎化学）［工化2・工化4］(2)

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

Grading is based on the examination held at the end of the semester. The attendance rate and the reports submitted during the course may be counted in evaluation.

[Textbook]

Daniel C. Harris, Quantitative Chemical Analysis, 9th ed., Freeman (2016) isbn{}{9781464135385}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学Ⅰ（工業基礎化学）［工化2・工化4］ Organic Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OOE KOUICHI Graduate School of Engineering Associate Professor,MIURA TOMOYA Institute for Chemical Research Professor,NAKAMURA MASAHARU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学数学Ⅰ（工業基礎化学） Mathematical Method in Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,ITOU AKIHIRO Center for the Promotion of Interdisciplinary Education and Research Program-Specific Associate Professor,FUKUDA　RYOICHI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Thu.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,6times,
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,3times,
,1time,
,7times,
,1time,
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,1time,

[Class requirement]

None

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

Continue to 化学数学Ⅰ（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	物理化学II（工業基礎化学）［工化1・工化3］ Physical Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SATO HIROFUMI Graduate School of Engineering Associate Professor,ITOU AKIHIRO Graduate School of Engineering Associate Professor,HIGASHI MASAHIRO Institute for Chemical Research Professor,MIZUOCHI NORIKAZU
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,2times,
,2times,
,2times,
,1time,
,1time,
,1time,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 物理化学II（工業基礎化学）［工化1・工化3］(2)↓↓↓

化学数学Ⅰ（工業基礎化学）(2)

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

物理化学II（工業基礎化学）［工化1・工化3］(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	物理化学II（工業基礎化学）［工化2・工化4］ Physical Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SATO HIROFUMI Graduate School of Engineering Associate Professor,ITOU AKIHIRO Graduate School of Engineering Associate Professor,HIGASHI MASAHIRO Institute for Chemical Research Professor,MIZUOCHI NORIKAZU
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

Continue to 物理化学II（工業基礎化学）［工化2・工化4］(2)↓↓↓

※

Numbering code			
Course title <English>	有機化学II（工業基礎化学）［工化1・工化3］ Organic Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SUGINOME MICHINORI Graduate School of Engineering Associate Professor,FUJIHARA TETSUAKI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

This course is designed for student who already learned basic organic chemistry. This course consists of three major parts. The first part concerns stereochemistry of organic compounds and reactions. The second part focuses on the reaction of saturated organic compounds bearing leaving groups. Nuceophilic substitution and elimination are involved in this part. The third part gives the details of the reactivities of unsaturated organic compounds bearing p-electrons such as alkenes, enols, enolates, and aromatic compounds.

[Course Goals]

[Course Schedule and Contents]

Stereochemistry,2times,Enantiomers; Diastereomers; Chiral compounds devoid of chiral centers; Symmetry, Optical resolution (Chapter 14)
Nucleophilic Substitution,3times,Mechanism; SN1 and SN2 reactions; Leaving group; Nucleophiles; Elimination and Rearrangement (Chapter 15)
Elimination,2times,Effect of Nucleophiles on Elimination and Substitution; E1 and E2 Elimination; Role of leaving group; Stereochemistry of elimination; E1cB reaction (Chapter 17)
Electrophilic Addition to Alkenes,3times,Bromination, Epoxidation; Regio- and stereochemistry of electrophilic addition; addition to conjugated dienes; Mechanism, Halolactonization (Chapter 19)
Formation and Reaction of Enols and Enolate,2times,Keto-enol Tautomerization; Acid- and base-catalyzed enolization; Stable enols; Reactions involving enols and enolates as intermediates; Stable enolate equivalents; Reaction at the oxygen atoms of enol and enolate; Reactions of enol ethers (Chapter 20)
Aromatic Electrophilic Substitution,2times,Electrophilic substitution of benzene, phenol, and anilines; ortho/para and meta preferences (Chapter 21)
Examination,1time,

[Class requirement]

None

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

Continue to 有機化学II（工業基礎化学）［工化1・工化3］(2)↓↓↓

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

[Textbook]

Organic Chemistry (Second Edition; Clayden, Greeves, Warren; Oxford University Press: 2012) isbn{}{ 9780199270293}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学II（工業基礎化学）［工化2・工化4］ Organic Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Institute for Chemical Research Professor,MURATA YASUJIROU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Wed.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

This course is designed for student who already learned basic organic chemistry. This course consists of three major parts. The first part concerns stereochemistry of organic compounds and reactions. The second part focuses on the reaction of saturated organic compounds bearing leaving groups. Nuceophilic substitution and elimination are involved in this part. The third part gives the details of the reactivities of unsaturated organic compounds bearing p-electrons such as alkenes, enols, enolates, and aromatic compounds.

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

Organic Chemistry (Second Edition; Clayden, Greeves, Warren; Oxford University Press: 2012) isbn{}{9780199270293}

[Reference books, etc.]

（Reference books）

Continue to 有機化学II（工業基礎化学）［工化2・工化4］(2)↓↓↓

有機化学II（工業基礎化学）［工化2・工化4］(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	無機化学II（工業基礎化学） Inorganic Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Associate Professor,MIKI KOUJI Graduate School of Engineering Program-Specific Senior Lecturer,TAKATSU HIROSHI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Mon.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Inorganic Chemistry II is an advanced course after learning Basic Inorganic Chemistry and Inorganic Chemistry I.
Structures, electronic spectra and reaction mechanism in coordination chemistry of metal complexes and organometallic compounds are lectured.

[Course Goals]

Understanding of the basis of steric structure, electronic structure, electronic spectra and reaction mechanism in metal complexes and organometallic compounds

[Course Schedule and Contents]

19. d-Metal complexes: electronic structure and spectra,7times,
20. Coordination chemistry: reactions of complexes,4times,
21. d-Metal organometallic chemistry,3times,
Lecture review,1time,

[Class requirement]

None

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

Grades based on attendance and a final exam.

[Textbook]

Shriver and Atkins Inorganic Chemistry [4th edition, Tokyo Kagakudojin] P.W.Atkins T.L.Overton J.P. Rourke M.T.Weller F.A.Armstrong, (translators) K.Tanaka, K.Hirao, S.Kitagawa ibid{}{BB02556341}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

d-Metal complexes, Electronic spectra, Steric structure and reaction mechanism of coordination compounds, Organometallic compounds

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	分析化学II（工業基礎化学） Analytical Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Global Environmental Studies Professor,ABE TAKESHI Institute for Chemical Research Professor,KAJI HIRONORI Graduate School of Engineering Associate Professor,NISHI NAOYA Institute for Integrated Radiation and Nuclear Science Associate Professor,TAKAMIYA KOUICHI Graduate School of Engineering Associate Professor,MASAYUKI MORI Institute for Integrated Radiation and Nuclear Science Professor,OTSUKI TSUTOMU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

As an introductory course of instrumental analysis, the lectures on chromatography, spectroscopy, electroanalytical chemistry, and mass spectrometry, will be given,

[Course Goals]

[Course Schedule and Contents]

Chromatography,3times,
Spectroscopy,4times,
Electroanalytical Chemistry,3times,
Mass spectroemtry,2times,
,1time,
,2times,

[Class requirement]

None

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

Grading will be mainly based on the score of the examination at the end of the semester. Attendance rate and the reports submitted may also be considered in evaluation.

[Textbook]

Daniel C. Harris, Quantitative Chemical Analysis (W. H. Freeman, 8th-ed., 2010) isbn{}{9781429239899}

[Reference books, etc.]

（Reference books）

Continue to 分析化学II（工業基礎化学）(2)↓↓↓

分析化学II（工業基礎化学）(2)

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	生化学Ⅰ（工業基礎化学） Basic Biochemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,UMEDA MASATO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU Graduate School of Engineering Associate Professor,MASAYUKI MORI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Tue.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,2times,
,2times,
,1time,
,2times,
,2times,
,1time,
,1time,
,1time,
,2times,
,1time,

[Class requirement]

None

Continue to 生化学Ⅰ（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	グリーンケミストリー概論 Introduction to Green Chemistry	Affiliated department, Job title,Name	Agency for Health, Safety and Environment Professor,HASHIMOTO SATOSHI Graduate School of Engineering Professor,EGUCHI KOUICHI Graduate School of Engineering Professor,OGOSHI TOMOKI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Thu.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,5times,
,5times,
,5times,
,4times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

生化学Ⅰ（工業基礎化学）(2)

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学概論 I （工業基礎化学） Introduction to Polymer Chemistry I (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,OGOSHI TOMOKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Thu.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,3times,
,1time,
,3times,
,2times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

[Class requirement]

Basic Organic Chemistry A, Basic Organic Chemistry B, Organic Chemistry I(Fundamental Chemistry), Organic Chemistry II(Fundamental Chemistry)

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

The grade is given based on the final examination.
Attendance and reports during the class could be considered.

[Textbook]

Organic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) isbn{}{9780199270293}

[Reference books, etc.]

（Reference books）
マクマリー 有機化学 ―生体反応へのアプローチ（マクマリー著；柴崎正勝，岩澤伸治，大和田智彦，増野匡彦　監訳；東京化学同人, 2009） isbn{}{9784807906918}

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

（Others (office hour, etc.)）

Two classes are lectured at the same time.

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	有機化学III（工業基礎化学）［工化1・工化3］ Organic Chemistry III (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KONDOU TERUYUKI Graduate School of Engineering Associate Professor,OOMURA TOSHIMICHI Graduate School of Engineering Associate Professor,KIMURA YUU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The lecture is given on Organic Chemistry which is indispensable to a researcher and an engineer. After the Organic Chemistry I (2nd year, 2nd term) and the Organic Chemistry II (3rd year, 1st term), the lecture is given on the chapters 22 - 26 of the same textbook, which covers characteristic reactions of electron-deficient alkenes and aromatic compounds, protection and deprotection of functional groups, and chemistry of carbonyl compounds including various reactivity of enolates.

[Course Goals]

Comprehensive understanding of reactions of aromatic compounds, reactivities of functional groups, and chemistry of carbonyl compounds including alkylation of enolates, the aldol reaction, and other condensation reactions is a goal of this course. By combining ideas learned in the Organic Chemistry I and the Organic Chemistry II, high-level knowledge of organic chemistry must be acquired which is indispensable for a accomplished researcher and engineer.

[Course Schedule and Contents]

Conjugate addition and nucleophilic aromatic substitution,3times,Conjugate addition reactions, conjugate substitution reactions, nucleophilic epoxidation, electrophilic aromatic substitution, addition-elimination mechanism, diazonium compounds, reactions via benzyne intermediate (Chapter 22)
Chemoselectivity and protecting groups,3times,Reducing agents, reduction of carbonyl groups, catalytic hydrogenation, removal of functional groups, dissolving metal reductions, selectivity in oxidation reactions, reactivities of functional groups, protecting groups (Chapter 23)
Regioselectivity,2times,Regioselectivity in electrophilic aromatic substitution reactions, electrophilic attack on alkenes, regioselectivity in radical reactions, nucleophilic attack on allylic compounds, electrophilic attack on conjugated dienes, direct addition vs. conjugate addition (Chapter 24)
Alkylation of enolates,3times,Alkylation of nitriles and nitroalkanes, electrophiles for alkylation, alkylation of lithium enolates, alkylation using enolate equivalents, alkylation of beta-dicarbonyl compounds, regioselectivity in alkylation of ketones (Chapter 25)
Reactions of enolates with carbonyl compounds: the aldol and Claisen reactions,3times,The aldol reaction, cross aldol condensation, aldol reactions using enolates and their equivalents, intramolecular aldol reaction, acylation of enolates, Claisen condensation, cross Claisen condensation, intramolecular cross Claisen condensation (Chapter 26)
,1time,
,1time,

Continue to 有機化学III（工業基礎化学）［工化1・工化3］(2)↓↓↓

※

Numbering code			
Course title <English>	有機化学III（工業基礎化学）［工化2・工化4］ Organic Chemistry III (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KONDOU TERUYUKI Graduate School of Engineering Associate Professor,OOMURA TOSHIMICHI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The lecture is given on Organic Chemistry which is indispensable to a researcher and an engineer. After the Organic Chemistry I (2nd year, 2nd term) and the Organic Chemistry II (3rd year, 1st term), the lecture is given on the chapters 22 - 26 of the same textbook, which covers characteristic reactions of electron-deficient alkenes and aromatic compounds, protection and deprotection of functional groups, and chemistry of carbonyl compounds including various reactivity of enolates.

[Course Goals]

Comprehensive understanding of reactions of aromatic compounds, reactivities of functional groups, and chemistry of carbonyl compounds including alkylation of enolates, the aldol reaction, and other condensation reactions is a goal of this course. By combining ideas learned in the Organic Chemistry I and the Organic Chemistry II, high-level knowledge of organic chemistry must be acquired which is indispensable for a accomplished researcher and engineer.

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

Basic Organic Chemistry A, Basic Organic Chemistry B, Organic Chemistry I(Fundamental Chemistry), Organic Chemistry II(Fundamental Chemistry)

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

The grade is given based on the final examination.
Attendance and reports during the class could be considered.

Continue to 有機化学III（工業基礎化学）［工化2・工化4］(2)↓↓↓

有機化学III（工業基礎化学）［工化2・工化4］(2)

[Textbook]

Organic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) isbn{}{9780199270293}

[Reference books, etc.]

（Reference books）
マクマリー 有機化学 ―生体反応へのアプローチ（マクマリー著；柴崎正勝，岩澤伸治，大和田智彦，増野匡彦　監訳；東京化学同人, 2009） isbn{}{9784807906918}

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

（Others (office hour, etc.)）

Two classes are lectured at the same time.

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	無機化学III（工業基礎化学） Inorganic Chemistry III (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,EGUCHI KOUICHI Graduate School of Engineering Professor,KAGEYAMA HIROSHI Graduate School of Energy Science Associate Professor,TAKAI SHIGEOMI Institute for Chemical Research Professor,MIZUOCHI NORIKAZU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Fri.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

This class deals with the topics related to inorganic solids, such as synthesis methods, structures, and properties

[Course Goals]

Goal of the class is to understand the synthesis method and characterization of inorganic solids, crystals structure, crystallography and diffraction techniques, phase diagrams, crystal defects, non-stoichiometry, solid solutions, and bonding in solids.

[Course Schedule and Contents]

Synthesis method,2times,Solid state reaction, gas phase methods, liquid phase methods, intercalation, electrochemical methods, single crystal growth, and hydrothermal methods will be lectured.
Characterization of solids,2times,The characterization of solids will be lectured, such as optical microscope, electron microscope, IR spectroscopy, Raman spectroscopy, NMR, XAFS, and thermal analysis.
Crystal Structure,2times,Symmetry in crystals will be lectured from the point view of the crystal structures.
Crystallography and diffraction techniques,2times,Crystallography and x-ray diffraction methods will be lectured.
Phase diagrams,2times,Phase diagrams including actual chemical compounds and their interpretations will be lectured.
Crystal defects, non-stoichiometry, solid solutions,2times,Solid solution, several types of the defects in solids will be lectured.
Electrical properties,2times,Metallic conductivity, superconductivity, semiconductivity, and ionic conductivity will be lectured.
Term-end examination,1time,Understanding of this class will be examined.

[Class requirement]

None

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

Grading will be determined by a term-end examination

[Textbook]

Solid State Chemistry and its Applications (2nd Edition, Wiley), A. R. West isbn{}{9781119942948}
The following textbooks are also allowed.

Continue to 無機化学III（工業基礎化学）(2)↓↓↓

Numbering code			
Course title <English>	物理化学III（工業基礎化学）［工化1・工化3］ Physical Chemistry III (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,SUGASE KENJI Graduate School of Engineering Associate Professor,UMEYAMA TOMOKAZU Graduate School of Engineering Senior Lecturer,HIGASHIGUCHI KENJI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Fundamentals of spectroscopy, Molecular structure and rotational and vibrational spectra, Electronic transitions and photochemistry, Magnetic resonance, Statistical thermodynamics, Molecular Interactions

[Course Goals]

The goal of this course is to understand basic concept of spectroscopy and statistical thermodynamics.

[Course Schedule and Contents]

Fundamentals of spectroscopy, 1time
Rotational and vibrational spectroscopy, 4times
Electronic transitions and photochemistry, 2times
Magnetic resonance, 3times
Statistical thermodynamics, 4times
Lecture review, 1time

[Class requirement]

The following are prerequisites for this class:
Physical Chemisry: Fundamentals and Exercises
Physical Chemistry I
Physical Chemistry II

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

Grades will be evaluated based on final examination, short reports, and class attendance.

[Textbook]

P. W. Atkins 『Physical Chemistry, 10th edition』 （Oxford University Press）

[Reference books, etc.]

（Reference books）
W. J. Moore 『Physical Chemistry, 4th edition』 （Prentice-Hall）

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

The basic knowledge of quantum mechanics is prerequisite for this class, so we recommend to review it before the class.

（Others (office hour, etc.)）

Two parallel classes will be held based on the class assignment.

*Please visit KULASIS to find out about office hours.

無機化学III（工業基礎化学）(2)

Basic Solid State Chemistry (Second Edition), A.R.West, John Wiley ampSons (1999) isbn{}{9780471987567}
ウエスト固体化学入門（講談社） isbn{}{4061533711}

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

Homework is to read the textbook before the class and to solve the problem.

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	高分子化学概論II（工業基礎化学） Introduction to Polymer Chemistry II (Fundamental Chemistry)	Affiliated department, Job title,Name	Institute for Chemical Research Professor,WATANABE HIROSHI Institute for Chemical Research Professor,KAJI HIRONORI Institute for Chemical Research Associate Professor,MATSUMIYA YUMI Institute for Chemical Research Assistant Professor,SHIZU KATSUYUKI Institute for Chemical Research Assistant Professor,SUZUKI KATSUAKI
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Characteristic structures (such as crystalline and amorphous structures) and characteristic properties (such as viscoelasticity) of polymers result from the thread-like primary structure of polymer molecules. Focusing on this point, this lecture addresses the structures and properties of polymers in solutions, in melts, and in solids.

[Course Goals]

To understand molecular origin(s) of the characteristic structures, dynamics, and properties of polymers.

[Course Schedule and Contents]

Conformation of Polymer Chain,2times,The conformation distribution of flexible polymers and the relationship between their average size and molecular weight are explained.
Solution Properties,3times,The thermodynamic behavior of polymer solutions, such as the osmotic pressure and phase separation,is explained on the basis of the Flory-Huggins theory. For this purpose, molecular expressions are derived for the mixing entropy, mixing enthalpy, and chemical potential. In addition, a brief introduction is given for methods of molecular weight determination on the basis of the solution properties.
Structure in Solid State,2times,Various morphology of crystalline polymers, i.e., single crystal, spherulite, lamellar crystalline, and extended chain crystal, are introduced and basic crystallization processes giving this variety of morphology are explained. In addition, methods of analysis of these crystalline structures are intriduced and the results of the analysis are explained.
Glass Transition,1time,The glass transition phenomenon is explained in relation to the thermal motion of polymer chains. Changes of the thermal and mechanical properties on this transition are explained are related to the motion of the polymer chains.
Rubber Elasticity,2times,From a molecular point of view, the conformation distribution of flexible polymer chains above the glass transition point is related to the rubber elasticity. The molecular expression is derived for the stress and modulus of rubbers.
Polymer Dynamics,4times,The viscoelastic behavior of flexible polymer melts is related to the large scale motion of the polymer chains. In particular, the entanglement effect due to the uncrossability of the chains is explained from a molecular point of view, and some basic models are introduced. In addition, for polymers having type-A dipoles parallel along the chain backbone, a relationship between viscoelastic and dielectric properties is explained.
Summary,1time,Essence of the whole lecture and a relationship among all items in the lecture are summarized, thereby improving the understanding of the attending students in particular for the items not well addressed in the the exams.

Continue to 高分子化学概論II（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	化学統計力学(工業基礎化学） Statistical Mechanics for Chemistry (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SEKI SYUHEI
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Mon.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,1time,
,2times,
,1time,
,3times,
,3times,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

高分子化学概論II（工業基礎化学）(2)

[Class requirement]

The students taking this class are desired to learn the basic part of polymer science at the class quotIntroduction to Polymer Chemistry I (Fundamental Chemistry)quot.

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

Judged on the basis of home-work reports and the final exam.

[Textbook]

Printed documents are distributed in the class.

[Reference books, etc.]

（Reference books）

Shin Kobunshi Kagaku Joron (a book published from Kagaku Dojin) isbn{}{4759802584}
Kobunshi no Kouzou to Bussei (a book published from Koudansha) ISBN978-4-06-154380-5 isbn{}{9784061543805}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	先端機器分析科学（工業基礎化学） Frontiers in Instrumental Analytical Science (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Advanced instrumental methods in analytical chemistry will be delivered.

[Course Goals]

[Course Schedule and Contents]

Introduction to advanced instrumental analysis,1time,
Highly functionalized column packing and its application to separation analysis,4times,
Fundamentals and applications of advanced X-ray absorption analysis,4times,
Fundamentals and applications of pH meters,6times,

[Class requirement]

Analytical Chemistry I and II are highly recommended.

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

The attendance rate and the reports submitted will be considered in evaluation.

[Textbook]

None

[Reference books, etc.]

（Reference books）

None

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学数学II Mathematical Method in Chemistry II	Affiliated department, Job title,Name	Fukui Institute for Fundamental Chemistry Professor,SATOU TOORU Graduate School of Engineering Assistant Professor,NAKANO HIROSHI Institute for Chemical Research Professor,MIZUOCHI NORIKAZU
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Fri.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,1time,
,3times,
,1time,
,4times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

有機化学IV（工業基礎化学）(2)

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

Before the class, read the textbook and check the contents.
When you have a question, ask via e-mail (kojimiki@scl.kyoto-u.ac.jp or anagaki@sbchem.kyoto-u.ac.jp).

（Others (office hour, etc.)）

Better to bring the textbook.

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	有機化学IV（工業基礎化学） Organic Chemistry IV (Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,MIKI KOUJI Graduate School of Engineering Associate Professor,NAGAKI AIICHIROU
Target year	4th year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Fri.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Organic transformations including stereoselective and stereospecific reactions, pericyclic reactions, and radical reactions, are reliable methods to construct complicated frameworks in highly-functionalized medicine and materials. In the class, stereoselective and stereospecific reactions of cyclic and non-cyclic compounds as well as non-ionic transformations, such as pericyclic reactions, rearrangement, and radical reactions, are explained.

[Course Goals]

-To understand stereoselective and stereospecific reactions of cyclic and non-cyclic compounds.
-To understand non-ionic transformations, such as pericyclic reactions, rearrangement, and radical reactions.

[Course Schedule and Contents]

-Stereoselectivity in cyclic molecules, 2 times
-Diastereoselectivity, 2 times
-Pericyclic reactions: cycloadditions, 2 times
-Pericyclic reactions: sigmatropic and electrocyclic reactions, 2 times
-Rearrangements, 2 times
-Fragmentation, 1 time
-Radical reactions, 3 times
-Final examination, 1 time

[Class requirement]

It is desirable for students to take classes of Organic Chemistry I, II, & III (Fundamental Chemistry) before this class.

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

Evaluation will be based on examinations (80%) and class performance includes attendance and short reports (20%).

[Textbook]

Nick Greeves, Stuart Warren, Peter Wothers, Jonathan Clayden 『Organic Chemistry 2nd Edition』（Oxford University Press）ISBN:978-0-199-27029-3

[Reference books, etc.]

（Reference books）

Continue to 有機化学IV（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	工業基礎化学実験Ｉ（工業基礎化学） Fundamental Chemistry Laboratory I(Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ATOMI HARUYUKI Faculty of Engineering 工基化学実験関連教員
Target year	3rd year students or above	Number of credits	7
Course offered year/period	2019/First semester		
Day/period	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,18times,
,18times,
,18times,
,11times,
,7times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	工業基礎化学実験II（工業基礎化学） Fundamental Chemistry Laboratory II(Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,TANAKA TSUNEHIRO Faculty of Engineering 工基化学実験関連教員
Target year	3rd year students or above	Number of credits	7
Course offered year/period	2019/Second semester		
Day/period	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,18times,
,18times,
,11times,
,7times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

生命化学基礎（工業基礎化学）(2)

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	生命化学基礎（工業基礎化学） Chemical Basis of Life(Fundamental Chemistry)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,UMEDA MASATO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU Graduate School of Engineering Associate Professor,KIYONAKA SHIGEKI Graduate School of Engineering Associate Professor,MASAYUKI MORI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Tue.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,3times,
,3times,
,3times,
,1time,
,1time,

[Class requirement]

None

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

[Textbook]

Continue to 生命化学基礎（工業基礎化学）(2)↓↓↓

※

Numbering code			
Course title <English>	科学英語（工業基礎化学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,SHIRAKAWA MASAHIRO Graduate School of Engineering Associate Professor,MIKI KOUJI Part-time Lecturer,BOLSTAD，Francesco
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.3	Class style	Lecture
Language	English		

[Outline and Purpose of the Course]

To understand scientific and technological English, and to learn how to express your ideas in English, especially English for practical use in the field of science and technology.

[Course Goals]

To play an active role internationally as scientists and engineers, an ability for expressing things in quotpracticalquot English is gained through understanding the way to write and explain backgrounds, questions, object, methods, results, discussion of the study in English.

[Course Schedule and Contents]

,1time,Workshop and talk with a native speaker.
,4times,To understand methods of expression in scientific papers and reports.
,4times,Technical writing.
,5times,Short presentations.

[Class requirement]

None

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

Regular easy reports.

[Textbook]

None

[Reference books, etc.]

（Reference books）

N/A

（Related URLs）

(N/A)

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

N/A

（Others (office hour, etc.)）

Available according to students#039 requests.

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	科学英語（工業基礎化学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,SHIRAKAWA MASAHIRO Graduate School of Engineering Associate Professor,MIKI KOUJI Part-time Lecturer,BOLSTAD, Francesco

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.4	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

To understand scientific and technological English, and to learn how to express your ideas in English, especially English for practical use in the field of science and technology.

[Course Goals]

To play an active role internationally as scientists and engineers, an ability for expressing things in quotpracticalquot English is gained through understanding the way to write and explain backgrounds, questions, object, methods, results, discussion of the study in English.

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

Regular easy reports.

[Textbook]

None

[Reference books, etc.]

（Reference books）

N/A

Continue to 科学英語（工業基礎化学）(2)↓↓↓

Numbering code			
Course title <English>	物理化学Ｉ（化学工学） Physical Chemistry I (Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,TANABE KATSUAKI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Thermodynamics is an essential subject to learn chemical engineering. This class provides an elementaly level of chemical engineering thermodynamics.

[Course Goals]

The goal is to learn the way to apply the basics of thermodynaaics to chemical process caluculations.

[Course Schedule and Contents]

Introduction,0.5times,
The First Low of Thermodynamics and Other Basic Concepts,0.5times,
Volumetric Properties of Pure Fluids,1.5times,
Thermochemistry,1.5times,
The Second Low of Thrmodynamics,2times,
Confirmation of the Level of Attainment 1,1time,
Balance for Open Systems,2times,
Thermodynamic Properties of Fluids,2times,
Phase Equilibrium,1time,
Application of Thermodynamics to Industrial Processes ,2times,
Confirmation of the Level of Attainment 2,1time,

[Class requirement]

The basic knowledge of physical chemistry is required.

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

The score is evaluated by reports (homeworks) and examinations.

[Textbook]

J. M. Smith and H. C. Van Ness : Introduction to Chemical Engineering Thermodynamics, Eighth Edition (McGraw-Hill International) isbn{}{9781259696527}

Continue to 物理化学Ｉ（化学工学）(2)↓↓↓

科学英語（工業基礎化学）(2)

（Related URLs）

(N/A)

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

N/A

（Others (office hour, etc.)）

Available according to students#039 requests.

*Please visit KULASIS to find out about office hours.

物理化学Ｉ（化学工学）(2)

[Reference books, etc.]

（Reference books）

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

For lectures using English textbooks, prepare in advance and understand the outline of the contents.
Since we pose homework of 1-3 problems from the end of the chapter every week, please submit the report at the bigining of next lecture.

（Others (office hour, etc.)）

Implement as many exercises as possible according to the progress of the lecture and try to acquire the content of the lecture. Impose tasks every week. Bring a scientific calculator.

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	無機化学Ⅰ（化学工学） Inorganic Chemistry I (Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SAKKA TETSUO Institute of Advanced Energy Professor,NOHIRA TOSHIYUKI Graduate School of Global Environmental Studies Professor,ABE TAKESHI Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Program-Specific Associate Professor,HOSOKAWA SABUROU Graduate School of Global Environmental Studies Associate Professor,FUKUTSUKA TOMOKAZU Graduate School of Engineering Professor,ABE RYUU

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

In quotInorganic Chemistry I (Chemical Engineering)quot, following five topics will be explained: 1) Acids and bases of inorganic compounds 2) Oxidation and reduction 3) Concept of group theory, which is necessary for the understanding of molecular structures 4) Fundamentals of coordination compounds, 5) Corrosion

[Course Goals]

[Course Schedule and Contents]

Asids and Bases,4times,
Oxidation and Reduction,4times,
Corrosion,3times,
Molecular Symmetry,4times,
Coordination compounds,2times,
Evaluation,1time,

[Class requirement]

Based on the understanding of quotFundamental Inorganic Chemistryquot, lectures will be done.

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

Grading is based on the examination held at the end of the semester. The attendance rate and the reports submitted during the course may be counted in evaluation.

Continue to 無機化学Ⅰ（化学工学）(2)↓↓↓

Numbering code			
Course title <English>	化学工学数学Ⅰ（化学工学） Mathematics for Chemical Engineering I (Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NAGAMINE SHINSUKE Graduate School of Engineering Associate Professor,TANIGUCHI TAKASHI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Thu.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

The aim of this class is to learn the fundamental mathematics commonly used in Chemical Process Engineering, Chemical System Engineering, such as ordinary differential equations, Laplace transformation, methods to solve differential equations by using Laplace transformation, and vector analysis. The style of the class is mainly lecture style.

[Course Goals]

To attain the mathematical knowledge and skill how to solve ordinal differential equations by using Laplace transformations

[Course Schedule and Contents]

Vector Analysis,7times,We learn the following items: \\ Vector Analysis (including differentiation of vectors), \\ Integration of vectors\\ Integral Theorem (Gauss divergence Theorem, Stokes Theorem)
Ordinary differential Equation,4times,We learn that various physical phenomena seen in our daily life can be described by ordinary differential equations. \\ As method to solve 1st and 2nd order ordinary differential equation, the following methods will be learned : 1. Method of separation of variables \\ 2. Method of variation of parameters \\
Laplace Transformation,3times,After learning the historical background and the discovery of Laplace transformation. We learn how to solve ordinal differential equations and integral equations by using Laplace transformation, and also learn applications of Laplace transformation to definite integration.
Confirmation of the level of attainment,1time,Confirmation of the level of attainment\\ Comments on the term-end Exam

[Class requirement]

Basic knowledge on differentiation, integral, matrix operations

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

Grade will be evaluated by (i) the examination at the end of semester and (ii) homework during semester.

[Textbook]

戸田 盛和 『ベクトル解析 (理工系の数学入門コース 3)』（岩波書店）ISBN:4000077732
布川 昊 『ラプラス変換と常微分方程式』（昭晃堂）ISBN:4785670215

[Reference books, etc.]

（Reference books）
佐藤 總夫 『自然の数理と社会の数理』（日本評論社）ISBN:4535603014

Continue to 化学工学数学Ⅰ（化学工学）(2)↓↓↓

無機化学Ⅰ（化学工学）(2)

[Textbook]

Inorganic Chemistry (4th edition) P. Atkins、T. Overton、J. Rourke、M. Weller、F. Armstrong isbn{}{ 0199264635}

[Reference books, etc.]

（Reference books）
Supplemental explanation will be delivered at the first class.

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

化学工学数学Ⅰ（化学工学）(2)

大岩 正芳 『化学者のための数学十講』（化学同人）ISBN:4759800085

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

After each class of vector analysis, homework is given to students, and their solution will be shown at the class in two weeks.
It is highly recommended that students solve them before the class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	流体系分離工学 Fluid-Phase Separation Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Professor,SANO NORIAKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Thu.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Chemical Processes consist of variety of units and operations. Here, distillation, gas absorption, extraction, and so forth which aim substance separation and purification will be lectured from basic principle and phenomena to kinetics and quantitative expression.

[Course Goals]

By taking typical separation operations as examples, mass balance, the students will understand the concept of mass transfer, and equilibrium, and they will master how to use them in quantitative manner. Additionally, they cultivate their ability to use differential contact operation and stage operation.

[Course Schedule and Contents]

Fundamental of mass separation and mass purification,3times,Principles and methods in substance separation and purity, which are important for chemical process, will be lectured. Fundamentals of molecular diffusion and mass transport will be explained.
gas absorption,4times,Equilibrium of gas with liquid, diffusion in liquid phase, gas diffusion rate, and design of gas absorption will be lectured, and the students will understand the idea of differential contact operation.
distillation,4times,Method to correlate the gas-liquid equilibrium will be lectured, and fundamental principle of distillation operation is explained as operation for purification of liquid mixture. The design method of continuous rectifying trays tower will be lectured as the most simple multi-stage contact operation method.
extraction,3times,Method to correlate the gas-liquid equilibrium will be lectured, and fundamental principle of distillation operation is explained as operation for purification of liquid mixture. The design method of continuous rectifying trays tower will be lectured as the most simple multi-stage contact operation method.
Feedback class,1time,A supplementary lecture or exercise class will be conducted as an additional class to give advanced knowledge or to confirm the attainment level of the course goals on diffusion, gas absorption and distillation.

[Class requirement]

Introduction to Industrial Chemistry (Material and energy balances), Fundamentals of Chemical Process Engineering,

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

Evaluation will be made based on midterm exam, routine exam at the end of semester, and reports often given in lectures.

Continue to 流体系分離工学(2)↓↓↓

Numbering code			
Course title <English>	物理化学II（化学工学） Physical Chemistry II (Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Assistant Professor,SUZUKI TETSUO Graduate School of Engineering Associate Professor,TANAKA HIDEKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Fri.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Based on the contents of Physical Chemistry I, you learn the phase transition and separation for multi-component systems, etc. Also, you learn molecular and solid-state physical chemistry in the view of quantum theory.

[Course Goals]

Understand the phase-separation phenomenon of multi-component systems, and master how to read the phase diagrams. Further, understand the quantum theory, its difference and relation to the physical chemistry of macroscopic systems.

[Course Schedule and Contents]

Physical chemistry of multi-component liquids and gases: 8 times

Physical chemistry of molecules and solids: 6 times

Feedback lecture: 1 time

[Class requirement]

Assume the completion of Physical Chemistry I (Chemical Engineering)

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

Final (end-term) exam score, etc.

[Textbook]

Atkins 『Physical Chemistry』（10th edition, Chaps. 4-10）

[Reference books, etc.]

（Reference books）

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

Remind the contents of Physical Chemistry I (Chemical Engineering).

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

流体系分離工学(2)

[Textbook]

quotGendai Kagaku Kogaku,quot K. Hashimoto and F. Ogino (Sangyo Tosho) isbn{}{4782826095}
quotKanso Gijutu Jitsumu Nyumon,quot H. Tamon (Nikkan Kogyo Shinbun) isbn{}{9784526069697}

[Reference books, etc.]

（Reference books）

quotKagakukikai no Riron to Keisan,quot S. Kamei (Sangyo Tosho) isbn{}{4782825099}

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

（Others (office hour, etc.)）

Lecture will be given basen on the textbook. Exercise problems will be given to students to deepen understanding in due course.

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	化学工学数学II Mathematics for Chemical Engineering II	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NAGAMINE SHINSUKE Graduate School of Engineering Associate Professor,TANIGUCHI TAKASHI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Fri.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

We will give a series of lectures on necessary mathematical knowledge and skills when students will learn subjects in the chemical engineering course, especially on Probability and Statistics, Fourier Transformation, Partial Differential Equations.

[Course Goals]

Goal of the class is that students attain necessary mathematical knowledge that is needed when students learn subjects in the chemical engineering course.

[Course Schedule and Contents]

Probability and Statistics (fundamentals),5times,1-1. Definition and properties of probability \\ 1-2. Conditional probability \\ 1-3. Stochastic variable and its properties \\ (a) Probability distribution function, \\ (b) Average, Expectation value, Moment, \\ (c) Moment generating function \\ 1-4. Multi-stochastic variable case \\ (a) simultaneous distribution function \\ (b) marginal and conditional probability \\ (c) covariance, correlation coefficient \\
Probability and Statistics,2times,1-5. Various distribution function \\ (a) binomialdistribution functions \\ (b) Poisson distribution functions \\ (c) Gauss distribution functions \\ 1-6. Law of large numbers \\ Central limit theorem \\ Normal distribution
Fourier Transformation,4times,3-1. Euler#039s formula \\ 3-2. Fourier integral \\ 3-3. Fourier transformation
Partial Differential Equation,3times,4. Fundamentals to solve partial differential equations \\ Equation of wave \\ Diffusion equation \\ Multi-dimensional problem
Confirmation of the level of attainment,1time,Confirmation of the level of attainment

[Class requirement]

It is required that students have already had the lecture : Mathematics for Chemical Engineering I in the former semester.

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

Grading will be determined by a test at the end of series of lectures, and reports and short tests in class, if necessary.

Continue to 化学工学数学II(2)↓↓↓

化学工学数学II(2)

[Textbook]

薩摩順吉 『理工系の数学入門コース 7. 確率・統計』（岩波書店）ISBN:4000077775
阿部寛治 『フーリエ解析と偏微分方程式』（培風館）ISBN:9784563011178

[Reference books, etc.]

（Reference books）
薩摩順吉 『岩波基礎物理シリーズ　10. 物理の数学』（岩波書店）ISBN:4000079301

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

After each class of Probability and Statistics, homework is given to students, and their solution will be shown at the class in two weeks.
It is highly recommended that students solve them before the class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	固相系分離工学 Solid-Phase Separation Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,WATANABE SATOSHI Graduate School of Engineering Professor,SANO NORIAKI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

To understand various separation opertions used in industrial chemical processes, multiphase transport phenomena, transport properties, methods to design separation operations will be lectured. Expecially, drying, adsorption, menbrane separation and crystallization will be taken as practical examples.

[Course Goals]

The present course aims at achieving the following three goals by taking some types of solid-phase separation operations for example: (1) understanding mass balance, heat balance, and simultaneous transport phenomena of mass and heat, (2) cultivating the ability to design and develop separation units and materials used for multi-phase separations, and (3) developing knowledge on recent trends of separation techniques.

[Course Schedule and Contents]

Adsorption Operations,4times,Adsorption equlibrium as dynamic equilibrium, adsorption isotherm, diffusion in pores and at surface, adsorption rate, and so forth will be explained. In addition, how to disign adsorption operation and how to calculate breakthrough curve in fixed bed type adsorbing column will be lectured.
Humidification Operations,1time,Humidication operation will be lectured as example of simultaneous transport of heat and mass at gas-liquid interface. The students will understand the idea of wet-bulb temperature and how to use humidity chart.
Drying Operations,4times,The mechanisms and kinetics of drying and expertise to select and desing of tne dyring unit type will be lectured, relating operation condistions with properties of the dried products.
Membrane Separation Operations,3times,With the main focus on the gas separation, permeability equations and process designs of membrane separation processes will be lectured.
Crystallization Operations,2times,The mechanism of the crystallization and kinetic analysis of the crystal growth will be lectured, followed by the explanation on the population balance required for the design of apparatuses. Finally, studentsrsquo understanding on the course will be tested.
Feedback class,1time,A supplementary lecture or exercise class will be conducted as an additional class to give advanced knowledge or to confirm the attainment level of the course goals.

[Class requirement]

Introduction to Industrial Chemistry (Material and energy balances),
Fundamentals of Chemical Process Engineering,
Fluid-Phase Separation Engineering

Continue to 固相系分離工学(2)↓↓↓

※

Numbering code			
Course title <English>	反応工学II Chemical Reaction Engineering II	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Senior Lecturer,ASHIDA RIYUUICHI

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/First semester
Day/period	Mon.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Kinetic analysis and reactor design of heterogeneous chemical reactions and nonideal flow reactors are described.

[Course Goals]

[Course Schedule and Contents]

Homogeneous and heterogeneous reactions,1time,
Complicated reaction rate equations,1time,
Macromixing and micromixing in nonideal flow,3times,
Gas-solid reactions and reactors,3.5times,
Solid-catalyst reactions and reactors,3.5times,
Gas-liquid and gas-liquid-solid-catalyst reactions and reactors,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

固相系分離工学(2)

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

Evaluation will be made based on midterm exam, routine exam at the end of semester, and reports often given in lectures.

[Textbook]

quotGendai Kagaku Kogaku,quot K. Hashimoto and F. Ogino (Sangyo Tosho) isbn{}{4782826095}
quotKanso Gijutu Jitsumu Nyumon,quot H. Tamon (Nikkan Kogyo Shinbun) isbn{}{9784526069697}

[Reference books, etc.]

（Reference books）
quotKagakukikai no Riron to Keisan,quot S. Kamei (Sangyo Tosho) isbn{}{4782825099}

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

（Others (office hour, etc.)）

Lecture will be given basen on the textbook. Exercise problems will be given to students to deepen understanding in due course.

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	物理化学III（化学工学） Physical Chemistry III (Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIYAHARA MINORU

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,1time,
,1time,
,1.5times,
,1.5times,
,2times,
,1time,
,1time,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

化学プロセス工学実験Ⅰ（化学工学）(2)

Hashimoto, Hanno Kogaku (Baifukan)isbn{}{4563045187}
Smith, Van Ness, Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Ed.(McGraw Hill) isbn{}{0071247084}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学プロセス工学実験Ⅰ（化学工学） ChemicalProcessEngineeringLaboratoryI(Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MIYAHARA MINORU Graduate School of Engineering Associate Professor,TANABE KATSUAKI Faculty of Engineering 化学工学実験関連教員

Target year	3rd year students or above	Number of credits	5	Course offered year/period	2019/First semester
Day/period	Thu.3,4,5,Fri.3,4,5	Class style	Experiment	Language	Japanese

[Outline and Purpose of the Course]

Experimental training on chemical analyses (gravimetric analysis, titration analysis) and fundamentals of chemical engineering (physical chemistry, transport phenomena, reaction engineering, etc.)

[Course Goals]

This course will enhance studentsrsquo understanding of quantitative chemical analysis and chemical engineering.

[Course Schedule and Contents]

Fundamentals on chemical analyses,15times,training regarding glass tools, electric balance, condensation, filtration, volumetric measurement, titration, etc. Also study tour for Kyoto University Environmental Preservation Research Center is organized to learn waste liquid treatment.
Chemical Engineering I/Physical Chemistry,14times,freezing point drop, precise measurement of liquid density and partial molar volume, Liquid-liquid equilibrium, gas-liquid equilibrium, measurement of gas diffusivity, fabrication of pH meter, surface tension and wettability
Chemical Engineering I/Transport Phenomena,4times,viscosity and flow dynamics, pressure drop in liquid flow
Chemical Engineering I/Reaction Engineering,4times,kinetic analysis in batch reactor, characterization of flow reactor
Chemical Engineering I/Apparatus Setup,2times,electric-cooling temperature-controlled batch,

[Class requirement]

Fundamentals of Chemical Process Engineering, Physical Chemistry I (Chemical Engineering), Fundamental Fluid Mechanics, Chemical Reaction Engineering I are recommend to take in advance.

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

Attendance, performance in experiments, reports will be evaluated.

[Textbook]

Textbook edited by teaching staff in department of chemical engineering

[Reference books, etc.]

（Reference books）

Bird, Stewart, Lightfoot, Transport Phenomena, 2nd Ed. (Wiley) isbn{}{9780470115398}
Hashimoto and Ogino, Gendai Kagaku Kogaku (Sangyo Tosyo) isbn{}{4782826095}

Continue to 化学プロセス工学実験Ⅰ（化学工学）(2)↓↓↓

※

Numbering code			
Course title <English>	化学プロセス工学実験II（化学工学） ChemicalProcessEngineeringLaboratoryII(Chemical Engineering)	Affiliated department, Job title,Name	Graduate School of Engineering Professor,YAMAMOTO RYOICHI Graduate School of Engineering Associate Professor,NAKAGAWA KYUUYA Faculty of Engineering 化学工学実験関連教員

Target year	3rd year students or above	Number of credits	5	Course offered year/period	2019/Second semester
Day/period	Wed.3,4,5,Thu.3,4,5	Class style	Experiment	Language	Japanese

[Outline and Purpose of the Course]

Experimental training of chemical engineering fundamentals(transport phenomena, separation engineering, reaction engineering, powder technology, process control)

[Course Goals]

This course will enhance studentsrsquo understanding of chemical engineering, and the students will learn typical operations in the experiments.

[Course Schedule and Contents]

Chemical Engineering II/Transport phenomena,9times,unsteady state heat transfer, heat transfer with forced flow, mass transport through interface
Chemical Engineering II/Separation Engineering,9times,continuous distillation, pressure drop and gas absorption in packed bed tower, cyclone characteristics for particle sizes
Chemical Engineering II/Reaction Engineering and Process Control,9times,gas-solid reaction, gas-solid catalytic reaction, , dynamic characteristics in process control

[Class requirement]

Physical Chemistry I, II (Chemical Engineering), Fundamental Fluid Mechanics, Transport Phenomena, Chemical Reaction Engineering I, II, Fluid Phase Separation Engineering, Fine Particle Technology, Process Control are recommend to take in advance.

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

Attendance, performance in experiments, reports will be evaluated.

[Textbook]

Textbook edited by teaching staff in department of chemical engineering

[Reference books, etc.]

（Reference books）

Bird, Stewart, Lightfoot, Transport Phenomena, 2nd Ed. (Wiley) isbn{}{9780470115398}
Hashimoto and Ogino, Gendai Kagaku Kogaku (Sangyo Tosyo) isbn{}{4782826095}
Hashimoto, Hanno Kogaku (Baifukan)isbn{}{4563045187}
Smith, Van Ness, Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Ed.(McGraw Hill) isbn{}{0071247084}

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	化学工学量論 Material and energy balances	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,TANABE KATSUAKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Balances of mass, volume, mole amount, and elements of substances as well as balance of energy is a fundamental of chemical engineering. Physical and chemical principles which are required for taking material and energy balance in problems about chemical processes are lectured. How to calculate the mass, component (element), and energy balance as for application processes is explained and practiced.

[Course Goals]

To acquire capability to analyze complicated chemical industrial processes from balance point of view as well as to cope with design and operation of chemical processes quantitatively.

[Course Schedule and Contents]

Week 1: Dimensions and units--- How to express dimensions and units, which are basic concept of measurement, and importance of dimensions and units is lectured.

Weeks 2--4: Fundamentals of material balance--- Flow system (closed and open), steady and unsteady operations, expression of composition of mixture, material balance over a single apparatus, and their exercises.

Weeks 5--6: Fundamentals of energy balance--- Forms of energy, calculation of apparent and latent heats, energy balance with no chemical reactions, and their exercises.

Weeks 7--8: Process flow diagram and unit operations--- Various unit operations, principles of separation processes, and process flow diagram are lectured.

Weeks 9--10: Material and energy balance of complicated processes--- Calculation of balance of processes including chemical reactions or phase changes is lectured. As well, how to understand material balance in case of many apparatus connected, merging, splitting, and recycling included is explained.

Weeks 11--13: Practice of taking balance in chemical processes--- Calculation of material and energy balance in complicated chemical processes is exercised.

Weeks 14: Scale-up. Methodology of scaling up apparatus is generally explained as well as introduction to kinetics required for design is lectured.

Week 15: Learning achievement evaluation.

Continue to 化学工学量論(2)↓↓↓

Numbering code			
Course title <English>	科学英語（化学工学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Part-time Lecturer,John Pryce
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.3	Class style	Lecture
Language	English		

[Outline and Purpose of the Course]

This course aims to give students an opportunity to use and expand on their current English skills in a Scientific context, specifically within the field of Chemical Engineering. In addition, since all instruction is in English, the course focuses on creating an environment where students can develop their overall skills in International Communication in both oral and written formats.

[Course Goals]

The goals of this course are: 1. To enable students to become conversant in English within various aspects of Chemical Engineering. 2. To improve and expand student#039s specialized vocabulary and pronunciation skills. 3. To give students confidence in oral and written communication skills regarding technical data, unit operations, process design and technical descriptions in English. 4. To develop student#039s overall ability in speaking, listening, reading and writing, as well as, critical thinking skills with regards to Chemical Engineering topics. 5. To develop and contribute to the student#039s confidence and knowledge to be able to attend international conferences, conduct presentations and publish papers in English.

[Course Schedule and Contents]

Unit 1-15,times,The course is divided into 15 classes over 15 weeks and the topics have been selected and sequenced to take the students through key aspects of Chemical Engineering beginning with elementary specialized vocabulary and pronunciation, culminating in technical trouble shooting and presentation of a solution.
Unit 1 Chemistry/Chemical Engineering - periodic table, organic and inorganic chemistry nomenclature, 1time,The student will be able to correctly pronounce and be aware of the differences in terminology between Japanese and English chemistry nomenclature.
Unit 2 Mathematical Sciences,1time,The student will be able to clearly explain mathematical operations, calculations and results obtained by experiment.
Unit 3 Units of Measurement/Explaining process equipment dimensions (piping, valves, instrumentation, pumps, vessels and various process equipment),1time,The student will be able to express units of measurement and Conversions, explain physical dimensions and process equipment features.
Unit 4-11 Unit Operations - Fluid Transportation, Heat Transfer, Mass Transfer, Thermodynamic Processes and Mechanical Processes,8times,The student will be able to describe various unit operations in English and describe how they integrate with different processes. Focusing on specific vocabulary, phrasal verbs and order of adjectives in describing.
Unit 12 Oral Assessment - Presentation of a unit operation,1time,The student will be able to present, describe and explain the application to a process for a unit operation of their choice.
Unit 13 Process and Instrumentation Diagrams incorporating unit operations,1time,The student will be able to read and explain process instrumentation diagrams in English.
Unit 14 Plant Start-up and Shut-down/operating instructions,1time,The student will be able to provide and describe sequencing instructions for plant operations.
Unit 15 Oral Assessment - Troubleshooting and explaining solutions,1time,The student will be able use

Continue to 科学英語（化学工学）(2)↓↓↓

化学工学量論(2)

[Class requirement]

Basic knowledge on thermodynamics lectured in Physical Chemistry: Fundamentals and Exercises, and Physical Chemistry I (Chemical Engineering) is required.

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

Evaluation will be based on exercises at class, assignments, and an examination.

[Textbook]

Masao Sudo ed. 『Kiso Kagakukogaku』 (Kyoritsu Shuppan) ISBN:9784320088702

[Reference books, etc.]

（Reference books）

Some handouts are given at class.

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

As many exercises as possible will be imposed at class. Assignments will be imposed every week. Bring a scientific calculator to the class.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

科学英語（化学工学）(2)

critical thinking skills to troubleshoot a Process and instrumentation diagram and explain their solution.

[Class requirement]

Students enrolled in the Chemical Process Engineering Course of the School of Industrial Chemistry.

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

Assessment 1 (week 12) - 20% Assessment 2 (week 15) - 20% Final Written exam - 60%

[Textbook]

Handouts will be given each lesson.

[Reference books, etc.]

（Reference books）

Nothing specified.

（Related URLs）

(Nothing specified.)

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

All instruction will be in English, so students are advised to work on improving listening skills both before and during the course.

（Others (office hour, etc.)）

Nothing specified.

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	科学英語（化学工学） Scientific English	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Part-time Lecturer,John Pryce

Target year	3rd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Mon.4	Class style	Lecture	Language	English

[Outline and Purpose of the Course]

This course aims to give students an opportunity to use and expand on their current English skills in a Scientific context, specifically within the field of Chemical Engineering. In addition, since all instruction is in English, the course focuses on creating an environment where students can develop their overall skills in International Communication in both oral and written formats.

[Course Goals]

The goals of this course are: 1. To enable students to become conversant in English within various aspects of Chemical Engineering. 2. To improve and expand student#039s specialized vocabulary and pronunciation skills. 3. To give students confidence in oral and written communication skills regarding technical data, unit operations, process design and technical descriptions in English. 4. To develop student#039s overall ability in speaking, listening, reading and writing, as well as, critical thinking skills with regards to Chemical Engineering topics. 5. To develop and contribute to the student#039s confidence and knowledge to be able to attend international conferences, conduct presentations and publish papers in English.

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

Students enrolled in the Chemical Process Engineering Course of the School of Industrial Chemistry.

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

Assessment 1 (week 12) - 20% Assessment 2 (week 15) - 20% Final Written exam - 60%

Continue to 科学英語（化学工学）(2)↓↓↓

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Numbering code			
Course title <English>	化学プロセス工学［Ｗ２０２（創成）］ Chemical Process Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,HASEBE SHINJI Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Graduate School of Engineering Associate Professor,WATANABE SATOSHI Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Professor,SANO NORIAKI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,3times,
,2times,
,2times,
,3times,
,1time,

[Class requirement]

None

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

[Textbook]

Continue to 化学プロセス工学［Ｗ２０２（創成）］(2)↓↓↓

科学英語（化学工学）(2)

[Textbook]

Handouts will be given each lesson.

[Reference books, etc.]

（Reference books）

Nothing specified.

（Related URLs）

(Nothing specified.)

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

All instruction will be in English, so students are advised to work on improving listening skills both before and during the course.

（Others (office hour, etc.)）

Nothing specified.

*Please visit KULASIS to find out about office hours.

化学プロセス工学［Ｗ２０２（創成）］(2)

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	化学プロセス工学［ＮＳ（工基礎）］ Chemical Process Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,HASEBE SHINJI Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Graduate School of Engineering Associate Professor,WATANABE SATOSHI Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Professor,SANO NORIAKI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Wed.1	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

Continue to 化学プロセス工学［ＮＳ（工基礎）］(2)↓↓↓

Numbering code			
Course title <English>	基礎流体力学 Fundamental Fluid Mechanics	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,TANIGUCHI TAKASHI

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Tue.2	Class style	Lecture	Language	Japanese

[Outline and Purpose of the Course]

Lecture on fundamentals of fluid dynamics needed for Chemical Engineering

[Course Goals]

Goal of this class is to understand the fundamental pricipals in fluid dynamics.

[Course Schedule and Contents]

Introduction to fluid dynamics,3times,0. Example of flows \\ 0-1. flow of ideal fluid \\ 0-2. Laminar flow \\ 0-3. Stability of flow \\ 0-4. Turbulent \\ 0-5. Computational fluid dynamics \\ 1. Properties of fluid \\ 1-1. Viscosity \\ 1-2. Compressibility \\ 1-3. Laminar and turbulent flows \\ 2. Quiescent fluid \\ 2-1. Pressure \\ 2-2. Buoyancy
Dynamics of Ideal Fluid,6times,3. Fundamentals on flows \\ 3-1. Particles and continuum body \\ 3-2. One dimensional flow \ 3-3. Three dimensional flow (Preparation of Mathematics) \\ 4-1. Mechanics in the ideal fluid \\ 4-2. Equation of continuity \\ 4-3. Euler#039s equation of motion \\ 4-4. Bernoulli#039s theorem \\ 4-5. Examples \\ 4-6. Streaming function and potential flow
Dynamics of viscous fluid,5times,5. Dynamics of viscous fluid \\ 5-1. Viscosity \\ 5-2. Stress tensor \\ 5-3. Exact soluble problems described by Navier-Stokes equation
Confirmation of the level of attainment,1time,Confirmation of the level of attainment\\ Comments on the term-end Exam

[Class requirement]

It is highly recommended for students to take the class: quotMathematics for Chemical Engineers Iquot.

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

Grade will be determined by (i) the examination at the end of semester and (ii) homeworks during semester.

[Textbook]

日野幹雄 『流体力学』（朝倉書店）ISBN:4254200668

Continue to 基礎流体力学(2)↓↓↓

化学プロセス工学［ＮＳ（工基礎）］(2)

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

基礎流体力学(2)

[Reference books, etc.]

（Reference books）

Bird, Stewart, Lightfoot 『Transport Phenomena 2nd Ed.』（Wiley）ISBN:9780470115398

（Related URLs）

(http://www-tph.cheme.kyoto-u.ac.jp/p/taniguch/class.html)

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

Because the content of the class basically follows the textbook raised above,
it is recommended that the students look through before the class.
In addition, because the students need fundamental knowledge of vector analysis as prerequisite knowledge, it is highly recommended for the students to parallelly take a class of "vector analysis".

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	化学工学計算機演習 Computer Programming in Chemical Engineering	Affiliated department, Job title,Name	Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Senior Lecturer,ASHIDA RIYUUICHI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Tue.4	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,3times,
,2times,
,3times,
,3times,
,1time,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	材料有機合成化学 Organic Material Synthetic Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA
Target year	3rd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Mon.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,1time,
,2times,
,4times,
,4times,
,1time,
,2times,
,1time,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code			
Course title <English>	反応工学 I Chemical Reaction Engineering I	Affiliated department, Job title,Name	Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUKI Graduate School of Engineering Professor,KAWASE MOTOAKI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/Second semester		
Day/period	Fri.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

Homogeneous chemical reaction engineering including kinetic analysis, design and operation of reactors, complex reactions, recycle reactors, semibatch operation, and nonisothermal reactors.

[Course Goals]

To understand stoichiometry and kinetics of complex reactions and mathematical models for design, operation, and kinetic analysis of homogeneous reactors including nonisothermal conditions and to be acquainted with those calculations.

[Course Schedule and Contents]

Design equations of isochoric and nonisochoric reactors,1time,
Reactor systems,2times,
Complex reactions,4times,
Kinetic analysis of reactions and design and operation of reactors,2.5times,
Nonisothermal reactors,4.5times,
,1time,

[Class requirement]

It is required to learn Fundamentals of Chemical Process Engineering and to have basic knowledge of ordinary differential equations and matrix.

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

Absolute evaluation based on the examination, assignments, and quizzes.

[Textbook]

Kenji Hashimoto 『Han'no Kogaku (Chemical Reaction Engineering)』 （Baifukan）

[Reference books, etc.]

（Reference books）

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

Take home assignments almost every week.

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	工業化学概論［工化1］ Introduction to Industrial Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MURAKAMI MASAHIRO
Target year	1st year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

,2times,
,2times,
,2times,
,2times,
,2times,
,2times,
,2times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	工業化学概論［工化2］ Introduction to Industrial Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MURAKAMI MASAHIRO
Target year	1st year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	工業化学概論［工化4］ Introduction to Industrial Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MURAKAMI MASAHIRO
Target year	1st year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

※

Numbering code			
Course title <English>	工業化学概論［工化3］ Introduction to Industrial Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,MURAKAMI MASAHIRO
Target year	1st year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.1	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class.\\
Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

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Numbering code			
Course title <English>	高分子化学序論 Introduction of Polymer Chemistry	Affiliated department, Job title,Name	Graduate School of Engineering Professor,AKIYOSHI KAZUNARI
Target year	2nd year students or above	Number of credits	2
Course offered year/period	2019/First semester		
Day/period	Wed.2	Class style	Lecture
Language	Japanese		

[Outline and Purpose of the Course]

[Course Goals]

[Course Schedule and Contents]

, **1** times,
, **5** times,
, **3** times,
, **4** times,
, **1** times,

[Class requirement]

None

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

[Textbook]

[Reference books, etc.]

（Reference books）

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

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.

Numbering code	U-ENG27 27407 EJ61		
Course title <English>	Chem-E-Car設計・実験 Chemical-E-Car Design and Experiment	Affiliated department, Job title,Name	Graduate School of Engineering Professor,SANO NORIAKI Faculty of Engineering

Target year	2nd year students or above	Number of credits	2	Course offered year/period	2019/Second semester
Day/period	Fri.4,5	Class style	Practical training	Language	Japanese

[Outline and Purpose of the Course]

制御された化学反応を駆動力とする化学自動車模型（Chem-E-Car）をグループで設計、製作する。設計開始前には電池や熱電効果等に関する実験を行い、Chem-E-Carに関する基礎を習得する。製作したChem-E-Carが、決められた荷重を搭載して目的とする距離を走行できるかをコンテスト形式で競う。

[Course Goals]

電池における物理化学を理解し、その活用についての理解を深める。
電気化学、熱電効果、発熱・吸熱、ガス発生等を含む、様々な化学・物理的現象を利用する発想力を磨く。
目的とするChem-E-Carの走行性能を実現するための化学反応の選択、制御の工夫を通して創造性を養う。

[Course Schedule and Contents]

（1）安全講習【１週】：Chem-E-Car作製、走行実験に必要な安全に関する講習
（2）基礎実習【５週】：電気化学、熱電効果、等に関する講義；一次電池、燃料電池、熱電効果等を使用したモデルChem-E-Carの作製
（3）設計方針討論【１週】：グループによるChem-E-Carの設計方針の討論
（4）工作実習【１週】：Chem-E-Carの製作に必要な工作技術や工作機械の使用方法の説明、実習
（5）Chem-E-Car製作、試運転【５週】：グループによるChem-E-Carの設計、製作、走行実験、基本データの採取
（6）発表会【１週】：グループによるChem-E-Carに関する発表（走行・停止の原理、特徴、等）
（7）コンテスト、講評会【１週】：Chem-E-Car走行コンテスト、Chem-E-Carの走行データに関する解説等

[Class requirement]

None

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

Chem-E-Carの走行性能（コンテスト結果）、成果報告会における発表、レポートにより評価する。

[Textbook]

教員が配布するプリント

Continue to Chem-E-Car設計・実験(2)↓↓↓

Chem-E-Car設計・実験(2)

[Reference books, etc.]

（Reference books）
アトキンス『物理化学（上）　第10版』

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

授業中に指示する

（Others (office hour, etc.)）

*Please visit KULASIS to find out about office hours.