Course number	U-ENG20 42105 LJ77		
Course title (and course title in English)	工学倫理 Engineering Ethics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Informatics Professor,KANDA TAKAYUKI Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Thu.3	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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)↓↓↓

[Study outside of class (preparation and review)]

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

（Other information (office hours, etc.)）

The class order is subject to change.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

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)

[Course requirements]

None

[Evaluation methods and policy]

Class participation and reports.

[Textbooks]

Lecture materials will be distributed.

[References, 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)↓↓↓

Course number	U-ENG25 35148 LJ57　U-ENG25 35148 LJ75		
Course title (and course title in English)	職業指導 Vocational Guidance	Instructor's name, job title, and department of affiliation	Part-time Lecturer,INOUE　MAKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

現代の日本は高学歴化が進み、学校教育において進学準備教育が重視される一方で、職業生活への移行にかかわる教育・訓練の機能は弱体化している。中等教育の目的の一つは、生徒の職業選択のための力量形成であり、さらに、専門高校では具体的な職業教育が行われてきた。本講義は、現代日本における職業教育の課題を理解するとともに、日本の専門高校における職業教育の実態を把握することを通じて、青年が生き方・働き方を主体的に選択できる教育とは如何なるものか、議論を深めることを目的とする。

[Course objectives]

・高校における職業教育の基本的な役割を理解する。
・国際比較の観点や労働市場との関係性をとおして、日本の高校職業教育の特徴を理解することができる。

[Course schedule and contents]

第1回　職業とは何か―その概念と種類
第2回　日本の学校における進路（職業）指導の起源と理論
第3回　学校と職業世界との接続(1)　日本的雇用システムと学校における進路指導の関係
第4回　学校と職業世界との接続(2)　日本の職業資格制度と学校教育
第5回　世界の職業教育―欧米における中等職業教育制度の特徴
第6回　技術・職業教育に関する国際的合意と日本の中等職業教育の位置
第7回　戦後の高校制度の性格と総合制―高校における職業教育の意義
第8回　専門高校における職業教育の実際(1)　進路指導のあり方と進路状況
第9回　専門高校における職業教育の実際(2)　職業資格・検定と専門教科の内容との関係
第10回　専門高校における職業教育の実際(3)　職場体験（インターンシップ）の実施と課題
第11回　日本の公的職業教育・訓練施設の種類と高校との接続関係
第12回　高等教育における職業教育―「専門職大学制度」の概要とこれから
第13回　日本におけるキャリア教育の提唱とその課題
第14回　日本の中等職業教育に関する課題の整理とその検討
第15回　総括・レポート試験

Continue to 職業指導(2)↓↓↓

職業指導(2)

[Course requirements]

None

[Evaluation methods and policy]

レポート試験の成績（60％）　平常点評価（40％）
平常点評価には、授業への参加状況、授業内での積極的発言を含む。

[Textbooks]

Instructed during class

[References, etc.]

（**Reference books**）
堀内達夫・佐々木英一・伊藤一雄・佐藤史人編『日本と世界の職業教育』（法律文化社）ISBN: 978-4-589-03511-0
佐藤史人・伊藤一雄・佐々木英一・堀内達夫編『新時代のキャリア教育と職業指導--免許法改定に対応して』（法律文化社）ISBN:978-4-589-03953-8

[Study outside of class (preparation and review)]

復習：授業で配布した資料等をよく読んで、講義内容の理解を深めておくこと。

（Other information (office hours, etc.)）

開講時期：令和2年8月26日（水）～8月31日（月）の土日を除く4日間の集中講義
各日ともⅠ時限～Ⅳ時限まで（8月28日（金）のみⅡ～Ⅳ時限）

*Please visit KULASIS to find out about office hours.

工学序論(2)

[Textbooks]

Specify if necessary.

[References, etc.]

（**Reference books**）
Specify if necessary.

[Study outside of class (preparation and review)]

Specify if necessary.

（Other information (office hours, etc.)）

Information about lecturers and contents of lectures are announced on electric bulletin boards.
Please confirm to your department office that the credit of this course is admitted to graduation requirements.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG20 22501 SJ77		
Course title (and course title in English)	工学序論 Introduction to Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,OHTA HIROTO Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI
Target year	1st year students or above	Number of credits	1
Year/semesters	2020/Intensive, First semester		
Days and periods	Intensive	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Engineering is to inquire after truth, to develop useful technologies, and to establish ways how to give back development results of technology to the society.
First, we offer special lectures regarding the basic knowledge that students in faculty of engineering are expected to have.
Then, we offer a series of intensive lectures about how engineering can suggest solutions of current and future problems of our society, the value of technology, and the responsibilities that researchers and engineers are expected to fulfill.

[Course objectives]

Students learn basic matters such as attitudes and responsibilities they are expected to take as a member of social community. They find value in studying engineering and become to consider what they do in future by understanding technology can suggest solutions of problems our society is facing, especially problems about safety and security.

[Course schedule and contents]

Special lectures,1time, About basic knowledge and attitude as students who start to learn engineering, and the role of engineering in society.
Intensive lectures,6times, A series of lectures offered by special lecturers playing on global stages of science and technology. Lectures are for understanding the role that technology is playing in modern society, for reconfirming importance to study engineering and to work as a researcher and engineer in society, and are to be opportunities to consider own future path. Essays are assigned in every lecture to summarize the lecture content and opinions of other students.
Schedule of the lectures are announced later.

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on participation and essays assigned in every intensive lecture.

Continue to 工学序論(2)↓↓↓

Course number	U-ENG23 23181 LJ73		
Course title (and course title in English)	ＧＬセミナーⅠ（企業調査研究） Global Leadership Seminar I	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI Graduate School of Engineering Senior Lecturer,KOMIYAMA YOSUKE
Target year	2nd year students or above	Number of credits	1
Year/semesters	2020/Intensive, year-round		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview 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 objectives]

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

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Not used

Continue to ＧＬセミナーⅠ（企業調査研究）(2)↓↓↓

GＬセミナーＩ（企業調査研究）(2)

[References, etc.]

（**Reference books**）

（**Related URLs**）

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

[Study outside of class (preparation and review)]

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

（**Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

工学部国際インターンシップ 1 (2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
A course that includes off-campus training classes.

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG23 33184 PJ73		
Course title (and course title in English)	工学部国際インターンシップ 1 Faculty of Engineering International Internship 1	Instructor's name, job title, and department of affiliation	Approved

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese and English

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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.

[Textbooks]

Continue to 工学部国際インターンシップ 1 (2)↓↓↓

Course number	U-ENG23 33182 LJ73		
Course title (and course title in English)	ＧＬセミナーＩＩ（課題解決演習） Global Leadership Seminar II	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,OHTA HIROTO

Target year	2nd year students or above	Number of credits	1	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview 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 objectives]

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.

[Course requirements]

None

[Evaluation methods and policy]

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.

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)**

[Textbooks]

Will be indicated as necessary.

[References, etc.]

（**Reference books**）
Will be indicated as necessary.

[Study outside of class (preparation and review)]

Will be indicated as necessary.

（**Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

工学部国際インターンシップ２**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
A course that includes off-campus training classes.

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 37137 LE48　U-ENG27 37137 LE61		
Course title (and course title in English)	工学部国際インターンシップ２ Faculty of Engineering International Internship 2	**Instructor's name, job title, and department of affiliation**	Approved

Target year	3rd year students or above	**Number of credits**	2	**Year/semesters**	2020/Intensive, year-round
Days and periods	Intensive	**Class style**	Seminar	**Language of instruction**	Japanese and English

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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.

[Textbooks]

Continue to 工学部国際インターンシップ２(2)↓↓↓

未更新

Course number	U-ENG27 37030 LJ61		
Course title (and course title in English)	有機工業化学 Industrial Organic Chemistry	**Instructor's name, job title, and department of affiliation**	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	**Year/semesters**	2020/Second semester
Days and periods	Wed.1	**Class style**	Lecture	**Language of instruction**	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Continue to 有機工業化学(2)↓↓↓

有機工業化学(2)

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

生物化学工学(2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37042 LJ61		
Course title (and course title in English)	生物化学工学 Biochemical Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,HAMACHI ITARU Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Program-Specific Associate Professor,TAKAHASHI NOBUAKI Graduate School of Engineering Senior Lecturer,TAMURA TOMONORI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 生物化学工学(2)↓↓↓

未更新

Course number	U-ENG27 37043 LJ61		
Course title (and course title in English)	環境保全概論 Introduction to Environment Preservation	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)↓↓↓

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.

[Course requirements]

None

[Evaluation methods and policy]

Evaluation: test scores + attendance rates.

[Textbooks]

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

[References, etc.]

(**Reference books**)
To be announced in class.

[Study outside of class (preparation and review)]

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

(**Other information (office hours, etc.)**)

*Please visit KULASIS to find out about office hours.

環境安全化学(2)

[Study outside of class (preparation and review)]

(**Other information (office hours, etc.)**)

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37046 LJ61 U-ENG27 37046 LJ76		
Course title (and course title in English)	環境安全化学 Chemistry and Environmental Safety	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

(**Reference books**)

Continue to 環境安全化学(2)↓↓↓

未更新

Course number	U-ENG27 37048 LJ61 U-ENG27 37048 LJ76		
Course title (and course title in English)	移動現象 Transport Phenomena	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,YAMAMOTO RYOICHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

(**Reference books**)

[Study outside of class (preparation and review)]

(**Other information (office hours, etc.)**)

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37052 LJ61		
Course title (and course title in English)	プロセス制御工学 Process Control	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)↓↓↓

プロセス制御工学(3)

[Courses delivered by instructors with practical work experience]

(1) Category

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

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.

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

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

[References, etc.]

（**Reference books**）
Process Control System, Ohshima, CORONA Publishing isbn{}{4339033146}

[Study outside of class (preparation and review)]

The final term project will be given.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Continue to プロセス制御工学(3)↓↓↓

未更新

Course number	U-ENG27 47056 LJ61		
Course title (and course title in English)	量子化学概論 Introduction to Quantum Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SATO HIROFUMI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 量子化学概論(2)↓↓↓

量子化学概論(2)

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 47061 LJ61		
Course title (and course title in English)	有機分光学 Spectroscopy for Organic Compounds	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA Institute for Chemical Research Associate Professor,TAKAYA HIKARU Graduate School of Engineering Professor,TANAKA KAZUO Institute for Chemical Research Associate Professor,HIROSE TAKASHI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 有機分光学(2)↓↓↓

未更新

Course number	U-ENG27 47059 LJ61		
Course title (and course title in English)	電気化学 Electrochemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

有機分光学(2)

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37064 LJ61		
Course title (and course title in English)	触媒化学 Catalyst Chemistry	Instructor's name, job title, and department of affiliation	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 Center for the Promotion of Interdisciplinary Education and Research Program-Specific Senior Lecturer,ASAKURA HIROYUKI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Continue to 触媒化学(2)↓↓↓

未更新

Course number	U-ENG27 37070 LJ61 U-ENG27 37070 LJ76		
Course title (and course title in English)	生化学II Basic Biochemistry II	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 生化学II(2)↓↓↓

触媒化学(2)

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

生化学II(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37071 LJ61　U-ENG27 37071 LJ76		
Course title (and course title in English)	微粒子工学 Fine Particle Technology	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Graduate School of Engineering Associate Professor,WATANABE SATOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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.

Continue to 微粒子工学(2)↓↓↓

Course number	U-ENG27 47072 LJ76　U-ENG27 47072 LJ61		
Course title (and course title in English)	プロセスシステム工学 Process Systems Engineering	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/Second semester
Days and periods	Thu.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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.

Continue to プロセスシステム工学(2)↓↓↓

微粒子工学(2)

General summary of course (1 class)
A summary, chiefly focused on dry powder operations.

[Course requirements]

None

[Evaluation methods and policy]

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.

[Textbooks]

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

[References, etc.]

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

[Study outside of class (preparation and review)]

Students must prepare for classes, and review after classes.

（Other information (office hours, etc.)）

Please visit KULASIS to find out about office hours.

*Please visit KULASIS to find out about office hours.

プロセスシステム工学(2)

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Lecture materials are distributed in the class.

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 37082 LJ76　U-ENG27 37082 LJ61		
Course title (and course title in English)	プロセス設計 Process Design	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SOTOWA KENICHIRO Faculty of Engineering

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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

Continue to プロセス設計(2)↓↓↓

未更新

Course number	U-ENG27 47096 LJ61		
Course title (and course title in English)	計算化学工学 Computers in Chemical Engineering	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/First semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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)↓↓↓

プロセス設計(2)

[Textbooks]

The reference materials are prepared by teachers.

[References, etc.]

（**Reference books**）

（**Related URLs**）

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

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

計算化学工学(2)

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

[Course requirements]

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

[Evaluation methods and policy]

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.

[Textbooks]

Text will be prepared by the tutors

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

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

（Other information (office hours, 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.

未更新

Course number	U-ENG27 37101 LJ61　U-ENG27 37101 LJ76		
Course title (and course title in English)	化学実験の安全指針 Safty in Chemistry Laboratory	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Intensive, First semester		
Days and periods	Intensive	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 化学実験の安全指針(2)↓↓↓

未更新

Course number	U-ENG27 27102 LJ60		
Course title (and course title in English)	化学工学シミュレーション Simulations in Chemical Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,YAMAMOTO RYOICHI Graduate School of Engineering Associate Professor,WATANABE SATOSHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 化学工学シミュレーション(2)↓↓↓

化学実験の安全指針**(2)**

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

化学工学シミュレーション**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 27103 LJ60		
Course title (and course title in English)	物理化学基礎及び演習［工化1］ Physical Chemistry: Fundamentals and Exercises	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KOGA TSUYOSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 物理化学基礎及び演習［工化1](2)↓↓↓

未更新

Course number	U-ENG27 27103 LJ60		
Course title (and course title in English)	物理化学基礎及び演習［工化2］ Physical Chemistry: Fundamentals and Exercises	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

物理化学基礎及び演習［工化1](2)

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 27103 LJ60		
Course title (and course title in English)	物理化学基礎及び演習［工化3］ Physical Chemistry: Fundamentals and Exercises	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 物理化学基礎及び演習［工化3］(2)↓↓↓

物理化学基礎及び演習［工化3］(2)

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

物理化学基礎及び演習［工化4］(2)

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 27103 LJ60		
Course title (and course title in English)	物理化学基礎及び演習［工化4］ Physical Chemistry: Fundamentals and Exercises	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 物理化学基礎及び演習［工化4］(2)↓↓↓

Course number	U-ENG27 27104 LJ60		
Course title (and course title in English)	有機化学基礎及び演習［工化1］ Exercises in Basic Organic Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAGAKI AIICHIROU Graduate School of Engineering Senior Lecturer,ISHIDA NAOKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course systematically studies the basic concepts and principles of organic chemistry through lectures and exercises. Particular attentions are focused on the chemistry of carbonyl group, which is one of the most important functional group in organic chemistry. The organic chemistry of amines and heterocyclic compounds are also studied.

[Course objectives]

Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemistry of carbonyl compounds, amines, and heterocycles.

[Course schedule and contents]

1. Aldehydes and ketones (2)
Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.

2. Nucleophilic addition reactions (3)
Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones.

3. Carboxylic acids and nitriles (1)
Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles

4. Carboxylic acid derivatives (2)
Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters and acid halides.

5. Nucleophilic acyl substitution reactions (2)
Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxylic acid derivatives.

6. alpha-Substitution and condensation reactions of carbonyl group (2)
Study on the reactions and reaction mechanisms involving enolate anions of ketons and esters, such as alkylations and aldol reactions.

7. Amines and heterocycles (2)
Study on the structure, properties, syntheses, and reactions of amines and heterocycles.

8. Feedback (1)

Continue to 有機化学基礎及び演習［工化1］(2)↓↓↓

有機化学基礎及び演習［工化1］(2)

[Course requirements]

Desirable to take Basic Organic Chemistry A and B.

[Evaluation methods and policy]

Evaluate based on a final written examination and exercises and tests during the lecture.

[Textbooks]

マクマリー『有機化学　生体反応へのアプローチ』（東京化学同人）ISBN:9784807906918

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Preparation and reviewing the textbook are needed.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

有機化学基礎及び演習［工化2］(2)

[Course requirements]

Desirable to take Basic Organic Chemistry A and B.

[Evaluation methods and policy]

Evaluate based on a final written examination and exercises and tests during the lecture.

[Textbooks]

マクマリー『有機化学　生体反応へのアプローチ』（東京化学同人）ISBN:9784807906918

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Preparation and reviewing the textbook are needed.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 27104 LJ60		
Course title (and course title in English)	有機化学基礎及び演習［工化2］ Exercises in Basic Organic Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course systematically studies the basic concepts and principles of organic chemistry through lectures and exercises. Particular attentions are focused on the chemistry of carbonyl group, which is one of the most important functional group in organic chemistry. The organic chemistry of amines and heterocyclic compounds are also studied.

[Course objectives]

Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemistry of carbonyl compounds, amines, and heterocycles.

[Course schedule and contents]

1. Aldehydes and ketones (2)
Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.

2. Nucleophilic addition reactions (3)
Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones.

3. Carboxylic acids and nitriles (1)
Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles

4. Carboxylic acid derivatives (2)
Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters and acid halides.

5. Nucleophilic acyl substitution reactions (2)
Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxylic acid derivatives.

6. alpha-Substitution and condensation reactions of carbonyl group (2)
Study on the reactions and reaction mechanisms involving enolate anions of ketons and esters, such as alkylations and aldol reactions.

7. Amines and heterocycles (2)
Study on the structure, properties, syntheses, and reactions of amines and heterocycles.

8. Feedback (1)

Continue to 有機化学基礎及び演習［工化2］(2)↓↓↓

Course number	U-ENG27 27104 LJ60		
Course title (and course title in English)	有機化学基礎及び演習［工化3］ Exercises in Basic Organic Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HAMACHI ITARU
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course systematically studies the basic concepts and principles of organic chemistry through lectures and exercises. Particular attentions are focused on the chemistry of carbonyl group, which is one of the most important functional group in organic chemistry. The organic chemistry of amines and heterocyclic compounds are also studied.

[Course objectives]

Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemistry of carbonyl compounds, amines, and heterocycles.

[Course schedule and contents]

1. Aldehydes and ketones (2)
Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.

2. Nucleophilic addition reactions (3)
Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones.

3. Carboxylic acids and nitriles (1)
Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles

4. Carboxylic acid derivatives (2)
Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters and acid halides.

5. Nucleophilic acyl substitution reactions (2)
Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxylic acid derivatives.

6. alpha-Substitution and condensation reactions of carbonyl group (2)
Study on the reactions and reaction mechanisms involving enolate anions of ketons and esters, such as alkylations and aldol reactions.

7. Amines and heterocycles (2)
Study on the structure, properties, syntheses, and reactions of amines and heterocycles.

8. Feedback (1)

Continue to 有機化学基礎及び演習［工化3］(2)↓↓↓

有機化学基礎及び演習［工化3］(2)

[Course requirements]

Desirable to take Basic Organic Chemistry A and B.

[Evaluation methods and policy]

Evaluate based on a final written examination and exercises and tests during the lecture.

[Textbooks]

マクマリー『有機化学　生体反応へのアプローチ』（東京化学同人）ISBN:9784807906918

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Preparation and reviewing the textbook are needed.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

有機化学基礎及び演習［工化4］(2)

[Course requirements]

Desirable to take Basic Organic Chemistry A and B.

[Evaluation methods and policy]

Evaluate based on a final written examination and exercises and tests during the lecture.

[Textbooks]

マクマリー『有機化学　生体反応へのアプローチ』（東京化学同人）ISBN:9784807906918

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Preparation and reviewing the textbook are needed.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27104 LJ60		
Course title (and course title in English)	有機化学基礎及び演習［工化4］ Exercises in Basic Organic Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course systematically studies the basic concepts and principles of organic chemistry through lectures and exercises. Particular attentions are focused on the chemistry of carbonyl group, which is one of the most important functional group in organic chemistry. The organic chemistry of amines and heterocyclic compounds are also studied.

[Course objectives]

Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemistry of carbonyl compounds, amines, and heterocycles.

[Course schedule and contents]

1. Aldehydes and ketones (2)
Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.

2. Nucleophilic addition reactions (3)
Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones.

3. Carboxylic acids and nitriles (1)
Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles

4. Carboxylic acid derivatives (2)
Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters and acid halides.

5. Nucleophilic acyl substitution reactions (2)
Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxylic acid derivatives.

6. alpha-Substitution and condensation reactions of carbonyl group (2)
Study on the reactions and reaction mechanisms involving enolate anions of ketons and esters, such as alkylations and aldol reactions.

7. Amines and heterocycles (2)
Study on the structure, properties, syntheses, and reactions of amines and heterocycles.

8. Feedback (1)

Continue to 有機化学基礎及び演習［工化4］(2)↓↓↓

Course number	U-ENG27 27105 LJ60　U-ENG27 27105 LJ76		
Course title (and course title in English)	基礎無機化学［T17，T18］ Basic Inorganic Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 基礎無機化学［T17，T18］(2)↓↓↓

基礎無機化学［T17，T18］(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 27105 LJ60　U-ENG27 27105 LJ76		
Course title (and course title in English)	基礎無機化学［T21，T22］ Basic Inorganic Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27105 LJ60　U-ENG27 27105 LJ76		
Course title (and course title in English)	基礎無機化学［T19，T20］ Basic Inorganic Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27111 LJ60		
Course title (and course title in English)	化学プロセス工学基礎［T17，T18］ Fundamental Chemical Process Engineering	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

Continue to 化学プロセス工学基礎［T17，T18］(2)↓↓↓

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

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.

[Course requirements]

None

[Evaluation methods and policy]

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

[Textbooks]

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

[References, 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 and augmented)』（Baifukan）ISBN:9784563046347

[Study outside of class (preparation and review)]

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

（Other information (office hours, 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).

Continue to 化学プロセス工学基礎［T19，T20］(3)↓↓↓

Course number	U-ENG27 27111 LJ60		
Course title (and course title in English)	化学プロセス工学基礎［T19，T20］ Fundamental Chemical Process Engineering	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)↓↓↓

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 27111 LJ60		
Course title (and course title in English)	化学プロセス工学基礎［T21，T22］ Fundamental Chemical Process Engineering	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Transport phenomenon of materials, energy, and momentum are important not only in chemical processes butalso 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 objectives]

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 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

Continue to 化学プロセス工学基礎［T21，T22］(2)↓↓↓

未更新

Course number	U-ENG27 27112 LJ60		
Course title (and course title in English)	有機化学Ⅰ（創成化学） Organic Chemistry I (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAO YOSHIAKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

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.

[Course requirements]

None

[Evaluation methods and policy]

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

[Textbooks]

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

[References, 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 (revisedand augmented)』（Baifukan）ISBN:4563045187

[Study outside of class (preparation and review)]

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

（Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 27113 LJ60		
Course title (and course title in English)	物理化学Ⅰ（創成化学） Physical Chemistry I (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 物理化学Ⅰ（創成化学）(2)↓↓↓

物理化学Ⅰ（創成化学）**(2)**

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

無機化学（創成化学）**(2)**

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 27114 LJ60		
Course title (and course title in English)	無機化学（創成化学） Inorganic Chemistry (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 無機化学（創成化学）(2)↓ ↓ ↓

未更新

Course number	U-ENG27 27115 LJ61 U-ENG27 27115 LJ62		
Course title (and course title in English)	分析化学（創成化学） Analytical Chemistry (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37117 LJ60		
Course title (and course title in English)	高分子化学基礎Ⅰ（創成化学） Elements of Polymer Chemistry I (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 高分子化学基礎Ⅰ（創成化学）(2)↓↓↓

未更新

Course number	U-ENG27 37118 LJ61		
Course title (and course title in English)	有機化学II（創成化学） Organic Chemistry II (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA SEIJIROU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

高分子化学基礎Ⅰ（創成化学）**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37119 LJ60		
Course title (and course title in English)	生体関連物質化学（創成化学） Biorelated Material Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 生体関連物質化学（創成化学）(2)↓↓↓

生体関連物質化学（創成化学）**(2)**

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 37121 LJ61		
Course title (and course title in English)	高分子化学基礎II（創成化学） Elements of Polymer Chemistry II (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37120 LJ61　U-ENG27 37120 LJ62		
Course title (and course title in English)	物理化学II（創成化学） Physical Chemistry II (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37122 LJ60		
Course title (and course title in English)	統計熱力学入門（創成化学） Introduction to Statistical Thermodynamics (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,IDA DAICHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37123 LJ60		
Course title (and course title in English)	機器分析化学（創成化学） Instrumental Analytical Chemistry (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

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

[References, etc.]

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

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37124 LJ60		
Course title (and course title in English)	有機化学III（創成化学） Organic Chemistry III (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 37126 LJ60		
Course title (and course title in English)	物理化学III（創成化学） Physical Chemistry III (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OOKITA HIDEO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)

Continue to 物理化学III（創成化学）(2)↓↓↓

物理化学III（創成化学）(2)

・ Magnetic resonance

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

Final examination/ Confirmation of extent of student learning

Feedback (1 class)

[Course requirements]

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).

[Evaluation methods and policy]

【Evaluation method】
Evaluation will be based on an examination (80%) and class performance (20%).
Evaluation for Participation in class includes attendance and evaluations of short reports.
【Evaluation policy】
Achievement of goals is evaluated according to the grade evaluation policy of the undergraduate.

[Textbooks]

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）

[References, etc.]

（**Reference books**）
Introduced during class
To be introduced during the course

[Study outside 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.

Continue to 物理化学III（創成化学）(3)↓↓↓

物理化学III（創成化学）(3)

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37129 LJ61		
Course title (and course title in English)	化学のフロンティア（創成化学） Frontier Chemistry (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OOUCHI MAKOTO Faculty of Engineering
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.4	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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

Continue to 化学のフロンティア（創成化学）(2)↓↓↓

未更新

Course number	U-ENG27 47127 LJ61		
Course title (and course title in English)	最先端機器分析（創成化学） Advanced Instrumental Analysis (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

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

[References, etc.]

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

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

化学のフロンティア（創成化学）(2)

introduced to showcase the frontlines of novel topics.

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.

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Assignments and individual reports will be appropriately instructed during classes.

（**Other information (office hours, etc.)**）

Course contents may be changed as necessary.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37130 LJ62　U-ENG27 37130 LJ61		
Course title (and course title in English)	化学生物学 Chemical Biology	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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

Continue to 化学生物学(2)↓↓↓

未更新

Course number	U-ENG27 27200 LJ60		
Course title (and course title in English)	高分子化学Ⅰ Polymer Chemistry I	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OOUCHI MAKOTO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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).

[Course requirements]

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

Continue to 高分子化学Ⅰ(2)↓↓↓

化学生物学(2)

[Course requirements]

None

[Evaluation methods and policy]

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

[Textbooks]

[References, 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}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

高分子化学Ⅰ(2)

[Evaluation methods and policy]

Written Examination

[Textbooks]

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.

[References, etc.]

（**Reference books**）
quotFundamentals in Polymer Sciencequot, Tokyo Kagaku Dojin: isbn{}{9784807906352}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG29 49121 LJ10　U-ENG29 49121 LJ24　U-ENG29 49121 LJ43		
Course title (and course title in English)	化学数学（創成化学） Mathematics of Chemistry(Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Continue to 化学数学（創成化学）(2)↓↓↓

未更新

Course number	U-ENG24 44073 LJ74		
Course title (and course title in English)	錯体化学（創成化学） Coordination Chemistry (Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

化学数学（創成化学）**(2)**

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 49992 GJ11　U-ENG29 49992 GJ12　U-ENG29 49992 GJ10		
Course title (and course title in English)	高分子化学II Polymer Chemistry II	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

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,

[Course requirements]

None

[Evaluation methods and policy]

Grading

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 47222 LJ60		
Course title (and course title in English)	創成化学実験Ⅰ（創成化学） Frontier Chemistry Laboratory I(Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 創成化学実験Ⅰ（創成化学）(2)↓↓↓

未更新

Course number	U-ENG27 37223 EJ61		
Course title (and course title in English)	創成化学実験Ⅱ（創成化学） Frontier Chemistry Laboratory II(Frontier Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 創成化学実験Ⅱ（創成化学）(2)↓↓↓

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37315 LE48　U-ENG27 37315 LE61		
Course title (and course title in English)	科学英語（創成化学） Scientific English	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA SEIJIROU Part-time Lecturer,John Pryce

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.3	Class style	Lecture	Language of instruction	English

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

None

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

無機化学Ⅰ（工業基礎化学）［工化1・工化3］(2)

[Evaluation methods and policy]

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.

[Textbooks]

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

[References, etc.]

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

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 27202 LJ60		
Course title (and course title in English)	無機化学Ⅰ（工業基礎化学）［工化1・工化3］ Inorganic Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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 Engineering Professor,ABE RYUU Graduate School of Global Environmental Studies Associate Professor,MIYAZAKI KOUHEI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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

[Course requirements]

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)↓↓↓

未更新

Course number	U-ENG27 27202 LJ60		
Course title (and course title in English)	無機化学Ⅰ（工業基礎化学）［工化2・工化4］ Inorganic Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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 Engineering Professor,ABE RYUU Graduate School of Global Environmental Studies Associate Professor,MIYAZAKI KOUHEI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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.

[Course requirements]

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)↓↓↓

無機化学Ⅰ（工業基礎化学）［工化2・工化4］(2)

[Evaluation methods and policy]

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.

[Textbooks]

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

[References, etc.]

（**Reference books**）

Supplemental explanation will be delivered at the first class.

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category

A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

分析化学Ⅰ（工業基礎化学）［工化1・工化3］(2)

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27203 LJ60		
Course title (and course title in English)	分析化学Ⅰ（工業基礎化学）［工化1・工化3］ Analytical Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

None

[Evaluation methods and policy]

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)↓↓↓

未更新

Course number	U-ENG27 27203 LJ60		
Course title (and course title in English)	分析化学Ⅰ（工業基礎化学）［工化2・工化4］ Analytical Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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.

[Course requirements]

None

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

分析化学Ⅰ（工業基礎化学）［工化2・工化4］(2)

[Evaluation methods and policy]

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.

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27204 LJ61 U-ENG27 27204 LJ55		
Course title (and course title in English)	有機化学Ⅰ（工業基礎化学）［工化2・工化4］ Organic Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

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

未更新

Course number	U-ENG27 27204 LJ61 U-ENG27 27204 LJ55		
Course title (and course title in English)	有機化学Ⅰ（工業基礎化学）［工化1・工化3］ Organic Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

有機化学Ⅰ（工業基礎化学）［工化2・工化4］(2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37207 LJ60		
Course title (and course title in English)	化学数学Ⅰ（工業基礎化学） Mathematical Method in Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 化学数学Ⅰ（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG27 37208 LJ60		
Course title (and course title in English)	物理化学II（工業基礎化学）［工化1・工化3］ Physical Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, 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)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, 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)**

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37208 LJ60		
Course title (and course title in English)	物理化学II（工業基礎化学）［工化2・工化4］ Physical Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

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

未更新

Course number	U-ENG27 37209 LJ60		
Course title (and course title in English)	有機化学II（工業基礎化学）［工化1・工化3］ Organic Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SUGINOME MICHINORI Institute for Chemical Research Professor,MURATA YASUJIROU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

[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,

[Course requirements]

None

[Evaluation methods and policy]

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

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37209 LJ60		
Course title (and course title in English)	有機化学II（工業基礎化学）［工化2・工化4］ Organic Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,FUJIHARA TETSUAKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

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

未更新

Course number	U-ENG27 37210 LJ60		
Course title (and course title in English)	無機化学II（工業基礎化学）［工化1・工化3］ Inorganic Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Global Environmental Studies Professor,ABE TAKESHI Institute for Integrated Cell-Material Sciences Professor,FUKAZAWA AIKO Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Associate Professor,MIKI KOUJI Graduate School of Engineering Associate Professor,SAKAMOTO RYOTA Institute for Advanced Study Professor,FURUKAWA SHIYUUHEI Institute for Advanced Study Associate Professor,HORIKE SATOSHI Graduate School of Engineering Program-Specific Senior Lecturer,TAKATSU HIROSHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

None

[Evaluation methods and policy]

Grades based on attendance and a final exam.

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

有機化学II（工業基礎化学）［工化2・工化4］(2)

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

無機化学II（工業基礎化学）［工化1・工化3］(2)

[Textbooks]

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}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

未更新

Course number	U-ENG27 37210 LJ60		
Course title (and course title in English)	無機化学II（工業基礎化学）［工化2・工化4］ Inorganic Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Global Environmental Studies Professor,ABE TAKESHI Institute for Integrated Cell-Material Sciences Professor,FUKAZAWA AIKO Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI Graduate School of Engineering Associate Professor,MIKI KOUJI Graduate School of Engineering Associate Professor,SAKAMOTO RYOTA Institute for Advanced Study Professor,FURUKAWA SHIYUUHEI Institute for Advanced Study Associate Professor,HORIKE SATOSHI Graduate School of Engineering Program-Specific Senior Lecturer,TAKATSU HIROSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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

[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.

[Course requirements]

None

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

未更新

Course number	U-ENG27 37211 LJ61		
Course title (and course title in English)	分析化学II（工業基礎化学） Analytical Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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 Senior Lecturer,TAMURA TOMONORI Graduate School of Engineering Assistant Professor,NAKAO AKITO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

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.

[Textbooks]

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

[References, etc.]

（**Reference books**）

Continue to 分析化学II（工業基礎化学）(2)↓↓↓

[Evaluation methods and policy]

Grades based on attendance and a final exam.

[Textbooks]

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}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, 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.

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37212 LJ61		
Course title (and course title in English)	グリーンケミストリー概論 Introduction to Green Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

生化学Ⅰ（工業基礎化学）**(2)**

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG27 37213 LJ61　U-ENG27 37213 LJ62		
Course title (and course title in English)	生化学Ⅰ（工業基礎化学） Basic Biochemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Senior Lecturer,KANAI TAMOTSU Graduate School of Engineering Associate Professor,HARA YUUJI Graduate School of Engineering Professor,HAMACHI ITARU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Continue to 生化学Ⅰ（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG27 37214 LJ60		
Course title (and course title in English)	高分子化学概論Ⅰ（工業基礎化学） Introduction to Polymer Chemistry I (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OGOSHI TOMOKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37215 LJ60		
Course title (and course title in English)	有機化学III（工業基礎化学）［工化1・工化3］ Organic Chemistry III (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

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

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

未更新

Course number	U-ENG27 37215 LJ60		
Course title (and course title in English)	有機化学III（工業基礎化学）［工化2・工化4］ Organic Chemistry III (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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)↓↓↓

[Evaluation methods and policy]

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

[Textbooks]

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

[References, 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}

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

Two classes are lectured at the same time.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

[Textbooks]

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

[References, 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}

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

Two classes are lectured at the same time.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 37216 LJ60		
Course title (and course title in English)	物理化学Ⅲ（工業基礎化学） Physical Chemistry III (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

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

Continue to 物理化学Ⅲ（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG27 37217 LJ61　U-ENG27 37217 LJ62		
Course title (and course title in English)	無機化学III（工業基礎化学） Inorganic Chemistry III (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

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

[Course objectives]

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.

[Course requirements]

None

[Evaluation methods and policy]

Grading will be determined by a term-end examination

[Textbooks]

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)↓↓↓

物理化学Ⅲ（工業基礎化学）(2)

[References, etc.]

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

[Study outside 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.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

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}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 47218 LJ61		
Course title (and course title in English)	高分子化学概論II（工業基礎化学） Introduction to Polymer Chemistry II (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)↓↓↓

未更新

Course number	U-ENG27 47219 LJ60		
Course title (and course title in English)	化学統計力学(工業基礎化学) Statistical Mechanics for Chemistry (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SEKI SYUHEI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, 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)

[Course requirements]

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.

[Evaluation methods and policy]

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

[Textbooks]

Printed documents are distributed in the class.

[References, 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}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37220 LJ61　U-ENG27 37220 LJ55		
Course title (and course title in English)	先端機器分析科学（工業基礎化学） Frontiers in Instrumental Analytical Science (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SAKKA TETSUO
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Advanced instrumental methods in analytical chemistry will be delivered.

[Course objectives]

[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,

[Course requirements]

Analytical Chemistry I and II are highly recommended.

[Evaluation methods and policy]

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

[Textbooks]

None

[References, etc.]

（**Reference books**）

None

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27300 LJ60		
Course title (and course title in English)	化学数学II Mathematical Method in Chemistry II	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/First semester
Days and periods	Fri.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

有機化学Ⅳ（工業基礎化学）(2)

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside 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).

（Other information (office hours, etc.)）

Better to bring the textbook.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37224 EJ61		
Course title (and course title in English)	有機化学Ⅳ（工業基礎化学） Organic Chemistry IV (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/First semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

-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

[Course requirements]

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

[Evaluation methods and policy]

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

Continue to 有機化学Ⅳ（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG23 23504 LE57		
Course title (and course title in English)	工業基礎化学実験Ⅰ（工業基礎化学） Fundamental Chemistry Laboratory I(Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/First semester
Days and periods	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG23 23505 LE55		
Course title (and course title in English)	工業基礎化学実験II（工業基礎化学） Fundamental Chemistry Laboratory II(Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.3,4,5,Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

生命化学基礎（工業基礎化学）(2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG25 35169 SJ71		
Course title (and course title in English)	生命化学基礎（工業基礎化学） Chemical Basis of Life(Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ATOMI HARUYUKI Graduate School of Engineering Professor,MORI YASUO 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 Senior Lecturer,TAMURA TOMONORI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 生命化学基礎（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG29 19124 LJ11		
Course title (and course title in English)	科学英語（工業基礎化学） Scientific English	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.3	Class style	Lecture
Language of instruction	English		

[Overview 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 objectives]

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.

[Course requirements]

None

[Evaluation methods and policy]

Regular easy reports.

[Textbooks]

None

[References, etc.]

（**Reference books**）
N/A

Continue to 科学英語（工業基礎化学）(2)↓↓↓

（Related URLs）

(N/A)

[Study outside of class (preparation and review)]

N/A

（Other information (office hours, etc.)）

Available according to students#039 requests.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

科学英語（工業基礎化学）(2)

（Related URLs）

(N/A)

[Study outside of class (preparation and review)]

N/A

（Other information (office hours, etc.)）

Available according to students#039 requests.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG29 19124 LJ11		
Course title (and course title in English)	科学英語（工業基礎化学） Scientific English	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.4	Class style	Lecture
Language of instruction	English		

[Overview 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 objectives]

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.

[Course requirements]

None

[Evaluation methods and policy]

Regular easy reports.

[Textbooks]

None

[References, etc.]

（Reference books）
N/A

Continue to 科学英語（工業基礎化学）(2)↓↓↓

未更新

Course number	U-ENG23 33290 SJ15　U-ENG23 33290 SJ14		
Course title (and course title in English)	物理化学Ｉａ（工業基礎化学） Physical Chemistry Ia (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TERAMURA KENTARO Center for the Promotion of Interdisciplinary Education and Research Program-Specific Senior Lecturer,ASAKURA HIROYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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】

[Course requirements]

前期配当の物理化学基礎及び演習の知識を必要とする。

[Evaluation methods and policy]

定期試験（１００点）または，平常点（５０点）と定期試験（５０点）
但し，平常点には予習・復習を含む課題，中間試験の評価を含む。
１００点満点中６０点以上を合格，５９点以下を不合格とする。

Continue to 物理化学Ｉａ（工業基礎化学）(2)↓↓↓

物理化学Ｉa（工業基礎化学）(2)

[Textbooks]

Not used

[References, 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:ISBN4-8079-0002-1 (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)

[Study outside 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。

（Other information (office hours, etc.)）

注意：「物理化学Ｉ（工業基礎化学）」を、すでに単位修得した学生が「物理化学Ｉa(工業基礎化学)」を履修し単位修得した場合、増加単位となる。
※オフィスアワーの詳細については、KULASISで確認してください。

*Please visit KULASIS to find out about office hours.

物理化学Ｉb（工業基礎化学）(2)

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 objectives]

物理化学基礎及び演習で学んだことをもとにして，
１）エントロピーの統計力学的な定義の理解と概念の会得
２）統計力学的に表現できる系の把握
３）現実的な系への拡張を目指したアンサンブルの考え方の会得
４）系を表現するさまざまな巨視的変数への展開
５）分光技術・材料や化学反応への応用
を具体的な学習目標とします。基礎統計力学をもとにして，応用熱力学・化学反応理論などの分野でこれを使いこなすための能力を養うことが目的です。今後誰もが目にする・耳にする情報を正しく判断するために，とても重要な概念・考え方の一つとして統計力学を捉えます。

最終的には、Maxwell-Boltzmannによる古典統計力学の体系で系を表現することの限界と，「なぜ量子論的な取扱いが必要になるのか？」を理解し、一般的な輻射の理論をもとにした量子力学的取り扱いの要請とは異なる，「熱」を中心とした物質の性質を表現するための量子力学的な取扱いの要請に至ることを目指します。

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.

[Course schedule and contents]

第1回：統計力学の原理と数学的準備
第2回：エントロピー：熱力学的アプローチと統計力学的定義
第3回： ボルツマンの原理へと至る過程とクラウジウスの理論
第4回：並進運動の速度分布
第5回：相転移における統計力学的取り扱い： 気化と気体の熱容量
第6回：気体分子の速度分布と分配関数

Continue to 物理化学Ｉb（工業基礎化学）(3)↓↓↓

Course number	U-ENG26 36205 LJ72				
Course title (and course title in English)	物理化学Ｉb（工業基礎化学） Physical Chemistry Ib (Fundamental Chemistry)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SEKI SYUHEI Institute for Chemical Research Professor,WATANABE HIROSHI		
Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Thu.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

物理化学は「繰り返し」の学問です。固体物理学とともに，おなじ概念を何度も何度も考え直すことで，最終的に理解が進む分野でしょう。さまざまな自然科学の分野で，「概念（コンセプト）」を会得できるまでには長い時間を要します。さまざまなデータや現象に接したときに，「この条件を変えればこのデータは・この現象はこのような変化をするはずだ」，「このデータ・現象を支配している因子は何なのか，それを調べるためにはこの条件を変化させてみよう」，などが自然と思い浮かぶというのが例えば「概念の体得」にあたります。そういう意味では熱統計力学はとても「物理化学」らしい分野でもあります。そして，いったん考えることをやめてしまったら，多分，一生理解が進まずに，物理化学的なもののとらえ方ができなくなってしまうのでしょう。

この講義では，単なる知識ではない「物理化学的な考え方」を通じ，社会全般・自然界で引き起こされる「現象」を定量的に理解するためのツールの一つとして活用できるようになることを目指しています。

物理化学分野の概念や理論構成のなかでも，私自身が最も「美しいもの」と思う統計力学・統計熱力学の体系を端緒に，授業の前半では主に「エントロピー」に着目した考え方を展開します。特に古典的・歴史的な熱力学による間接的なエントロピーの発見と応用の展開からは一旦離れ，統計理論に基づいた理論的なエントロピーの定義をもとに，現実的な系を表現していきます。後半では特に「エントロピー」をもとにした物質の性質や化学反応への応用を試みます。

ややレトリックな表現かもしれませんが，分子の結晶のような，エントロピーの小さな極限の状態は，だれが見ても美しいと考えると思いますが，さまざまな分子の個性を排除して，エントロピーの極大状態にある熱統計力学系において，それを支配する方程式群は，前者よりももっと美しいとも見えることの体現を目指します。

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.

Continue to 物理化学Ｉb（工業基礎化学）(2)↓↓↓

物理化学Ｉb（工業基礎化学）(3)

第7回：カノニカルアンサンブルと分配関数
第8回：分配関数とさまざまな熱力学量の関係
第9回： 統計力学の基礎に関する演習と到達度確認
第10回：弾性とエントロピー
第11回：ブラウン運動と衝突・拡散理論
第12回：アレニウスの式の導出と解釈
第13回：活性錯合体理論と絶対反応速度論
第14回：古典的取り扱いの限界
第15回：統計力学の応用展開と到達度確認

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. Fundamental Statistical Mechanics including Exercise
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
15. Statistical Mechanics Applications including Exercise

[Course requirements]

None

[Evaluation methods and policy]

以下のA，Bの方式のうち，点数が高い方を採用して評価とします。

A方式：期末テスト（100点）のみ
B方式：出席とQuestion Paper（各回２点）＋ 中間テスト + 期末テスト

試験における各種資料の持ち込みは基本的に認めません。
中間テストの結果については公開KULASISを通じて学籍番号を公表することがあります。

※注意※ 中間・期末試験の再試験・追試は行いません。

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.

Continue to 物理化学Ｉb（工業基礎化学）(4)↓↓↓

物理化学Ｉb（工業基礎化学）(4)

[Textbooks]

ムーア 『物理化学（上）』（東京化学同人）ISBN:978-4807900022

[References, etc.]

（Reference books）

吉田武 『オイラーの贈物』（東海大学出版会）ISBN:978-4486018636
Richard P. Feynman 『Feynman Lectures on Physics Vol1』ISBN:978-0465024933
田崎晴明 『統計力学I』（培風館）ISBN:978-4563024376

[Study outside of class (preparation and review)]

”Fermi推定”と言えるような，既知の定数・授業で取り扱う定式化された表現を用いて，登校中・帰宅中などの時間を活用してでも、随時身の回りの現象について考え，事象を定量的に見積もってみることをお勧めします。

Think quantitatively and calculate anything.

（Other information (office hours, etc.)）

オフィスアワーは授業日の夕方１７時から２時間
桂キャンパス　Bクラスタ　A4-009号室

基本的に質問はQuestion Paperを活用してください。
場合によってはe-mailによる質問も受け付けます。

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

注意：「物理化学Ｉ（工業基礎化学）」をすでに単位修得している学生が「物理化学Ｉｂ（工業基礎化学）」を履修し単位修得した場合、増加単位となる。

※オフィスアワーの詳細については、KULASISで確認してください。

*Please visit KULASIS to find out about office hours.

物理化学Ｉ（化学工学）(2)

[References, etc.]

（Reference books）

[Study outside 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.

（Other information (office hours, 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.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course
A lecture derived from an instructor’s practical work experience outside of academia

(3) Details of practical classes delivered based on instructors’ practical work experience

Course number	U-ENG27 27301 LJ60		
Course title (and course title in English)	物理化学Ｉ（化学工学） Physical Chemistry I (Chemical Engineering)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

The basic knowledge of physical chemistry is required.

[Evaluation methods and policy]

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

[Textbooks]

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)↓↓↓

未更新

Course number	U-ENG27 27302 LJ55　U-ENG27 27302 LJ76		
Course title (and course title in English)	無機化学Ｉ（化学工学） Inorganic Chemistry I (Chemical Engineering)	Instructor's name, job title, and department of affiliation	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 Graduate School of Global Environmental Studies Associate Professor,MIYAZAKI KOUHEI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

[Course schedule and contents]

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

[Course requirements]

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

[Evaluation methods and policy]

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.

[Textbooks]

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

Continue to 無機化学Ｉ（化学工学）(2)↓↓↓

無機化学Ⅰ（化学工学）**(2)**

[References, etc.]

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

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）
*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

化学工学数学Ⅰ（化学工学）**(2)**

[Course requirements]

Basic knowledge on differentiation, integral, matrix operations

[Evaluation methods and policy]

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

[Textbooks]

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

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

[Study outside 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.

（**Other information (office hours, etc.)**）
*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 37303 LJ61 U-ENG27 37303 LJ76		
Course title (and course title in English)	化学工学数学Ⅰ（化学工学） Mathematics for Chemical Engineering I (Chemical Engineering)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

To attain the mathematical knowledge and skill how to calculate a line, surface and volume integrals, and to calculate differentiations
of scalar and vector fields, and to solve ordinal differential equations by using Laplace transformations.

[Course schedule and contents]

Vector Analysis, (7-times)
We learn the following items:
1. Vector Analysis (including differentiation of vectors)
2. Integration of vectors\ Integral Theorem (Gauss divergence Theorem, Stokes Theorem)

Ordinary differential Equation, (4-times)
We learn that various physical phenomena seen in our daily life can be described by ordinary differential equations.
As a 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, (3-times)
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, (1-time)
Confirmation of the level of attainment
Comments on the term-end Exam

Continue to 化学工学数学Ⅰ（化学工学）(2)↓↓↓

Course number	U-ENG27 37304 LJ60		
Course title (and course title in English)	流体系分離工学 Fluid-Phase Separation Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Associate Professor,NAKAGAWA KYUUYA
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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)↓↓↓

流体系分離工学(2)

[Textbooks]

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}

[References, etc.]

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

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

Course number	U-ENG27 37307 LJ61 U-ENG27 37307 LJ76		
Course title (and course title in English)	化学工学数学II Mathematics for Chemical Engineering II	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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) (5-times)
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, (2-times)
1-5. Various distribution function
  (a) binomial distribution functions
  (b) Poisson distribution functions
  (c) Gauss distribution functions
1-6. Law of large numbers
  Central limit theorem
  Normal distribution

Fourier Transformation, (4-times)
3-1. Fourier integral
3-2. Fourier transformation

Partial Differential Equation (3-times)
4. Fundamentals to solve partial differential equations

Continue to 化学工学数学II(2)↓↓↓

未更新

Course number	U-ENG27 37305 LJ55 U-ENG27 37305 LJ76		
Course title (and course title in English)	物理化学II（化学工学） Physical Chemistry II (Chemical Engineering)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,ＴＡＮＡＢＥ　ＫＡＴＳＵＡＫＩ Graduate School of Engineering Assistant Professor,SUZUKI TETSUO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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

[Course requirements]

Assume the completion of Physical Chemistry I (Chemical Engineering)

[Evaluation methods and policy]

Final (end-term) exam score, etc.

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

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

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

化学工学数学II(2)

Equation of wave
Diffusion equation,
Multi-dimensional problem
Confirmation of the level of attainment (1-time),
Confirmation of the level of attainment

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

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

[References, 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

[Study outside 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.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 37308 LJ61　U-ENG27 37308 LJ76		
Course title (and course title in English)	反応工学II Chemical Reaction Engineering II	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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

[Course objectives]

Knowledge on the kinetic description of heterogeneous reactions.
Knowledge on the design and operation of various reactors, including non-ideal flow reactors.
Ability to perform such calculations for designing reactors.

[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,

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on a mark of the final written exam, submission of quizzes conducted in class, and reports on assignments conducted.

[Textbooks]

K. Hashimoto 『Han'no Kogaku (revised and augmented)』 （Baifukan） ISBN:9784563046347

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Read through the chapter of the textbook by the class starts and learn by yourself if understanding is insufficient after the class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

固相系分離工学(2)

[Evaluation methods and policy]

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

[Textbooks]

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}

[References, etc.]

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

[Study outside of class (preparation and review)]

（Other information (office hours, 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.

未更新

Course number	U-ENG27 37309 LJ60		
Course title (and course title in English)	固相系分離工学 Solid-Phase Separation Engineering	Instructor's name, job title, and department of affiliation	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	Year/semesters	2020/Second semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview 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 objectives]

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.

[Course requirements]

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)↓↓↓

未更新

Course number	U-ENG27 27400 LJ76　U-ENG27 27400 LJ61		
Course title (and course title in English)	物理化学III（化学工学） Physical Chemistry III (Chemical Engineering)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MIYAHARA MINORU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 物理化学III（化学工学）(2)↓↓↓

物理化学III（化学工学）(2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

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}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG27 27314 LJ61 U-ENG27 27314 LJ76		
Course title (and course title in English)	化学プロセス工学実験Ⅰ（化学工学） ChemicalProcessEngineeringLaboratoryI(Chemical Engineering)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/First semester		
Days and periods	Thu.3,4,5,Fri.3,4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

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

[Evaluation methods and policy]

Attendance, performance in experiments, reports will be evaluated.

[Textbooks]

Textbook edited by teaching staff in department of chemical engineering

[References, 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)↓↓↓

未更新

Course number	U-ENG27 17405 LJ60		
Course title (and course title in English)	化学プロセス工学実験II（化学工学） ChemicalProcessEngineeringLaboratoryII(Chemical Engineering)	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Wed.3,4,5,Thu.3,4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course requirements]

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.

[Evaluation methods and policy]

Attendance, performance in experiments, reports will be evaluated.

[Textbooks]

Textbook edited by teaching staff in department of chemical engineering

[References, 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}

Continue to 化学プロセス工学実験II（化学工学）(2)↓↓↓

化学プロセス工学実験II（化学工学）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

化学工学量論(2)

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

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

[References, etc.]

（Reference books）

Some handouts are given at class.

[Study outside 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.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

A course with practical content delivered by instructors with practical work experience

(2) Details of instructors' practical work experience related to the course

(3) Details of practical classes delivered based on instructors' practical work experience

未更新

Course number	U-ENG27 27406 LJ60		
Course title (and course title in English)	化学工学量論 Material and energy balances	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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)↓↓↓

Course number	U-ENG29 29125 EJ10　U-ENG29 29125 EJ55		
Course title (and course title in English)	科学英語（化学工学） Scientific English	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Part-time Lecturer,John Pryce
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.3	Class style	Lecture
Language of instruction	English		

[Overview 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 objectives]

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

Continue to 科学英語（化学工学）(2)↓↓↓

describe sequencing instructions for plant operations.
Unit 15 Oral Assessment - Troubleshooting and explaining solutions,1time,The student will be able use critical thinking skills to troubleshoot a Process and instrumentation diagram and explain their solution.

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Handouts will be given each lesson.

[References, etc.]

（**Reference books**）
Nothing specified.

（**Related URLs**）
(Nothing specified.)

[Study outside 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.

（Other information (office hours, etc.)）

Nothing specified.

*Please visit KULASIS to find out about office hours.

科学英語（化学工学）(2)

[References, etc.]

（**Reference books**）
Nothing specified.

（**Related URLs**）
(Nothing specified.)

[Study outside 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.

（Other information (office hours, etc.)）

Nothing specified.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 29125 EJ10　U-ENG29 29125 EJ55		
Course title (and course title in English)	科学英語（化学工学） Scientific English	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Part-time Lecturer,John Pryce
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.4	Class style	Lecture
Language of instruction	English		

[Overview 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 objectives]

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.

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Handouts will be given each lesson.

Continue to 科学英語（化学工学）(2)↓↓↓

Course number	U-ENG27 27401 LJ61　U-ENG27 27401 LJ76		
Course title (and course title in English)	化学プロセス工学［Ｗ２０２（創成）］ Chemical Process Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,WATANABE SATOSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Chemical processes are comprised of a combination of various operations (unit operations), and this course will discuss distillation, gas-absorption, and other fluid-based mass transfer unit operations for separating and purifying substances, as well as mechanical unit operations related to the production and processing of particulate matter (powders), beginning from an overview of their basic phenomena and operating principles together with the study of the related kinetic phenomena and their quantitative expression methods. Students will also learn methods for the safe operation and control of chemical processes.

[Course objectives]

Cultivate an understanding of the concepts of mass balance, mass transfer, equilibrium relationship, and control by studying examples of typical separation operations, particle-based separation operations, and process control in chemical processes. In addition, students will develop the ability to quantitatively analyze chemical processes.

[Course schedule and contents]

1. Basics of substance separation and purification, 2 sessions
These sessions will explain the principles and methods of separation and purification of important substances in chemical processes, as well as the fundamentals of molecular diffusion and mass transfer.

2. Gas absorption, 2 sessions
Students will learn the concept of the “differential contact method”, through lectures discussing equilibrium of gas dissolution in liquids, the diffusion phenomenon in the liquid phase, gas absorption rates, and design methods for gas absorption devices.

3. Distillation, 3 sessions
These sessions will describe the correlation method of vapor-liquid equilibria, explain the basic principles of various distillation operation methods for mixed liquid purification procedures, and explain the design method for a continuous rectification stage column, which is the simplest “multi-stage contact operation.”

4. Overview of particle system operation, 2 sessions
These sessions will describe the role of particle-based unit operations in chemical processes, the evaluation of particle characteristics, their methods of expression, and the behavior of particles.

Continue to 化学プロセス工学［Ｗ２０２（創成）］(2)↓↓↓

5. Gas-solid separation, 2 sessions
These sessions will describe the concept of partial separation efficiency, in addition to discussion of the principle of solid-gas separation and the methods for evaluating separation performance applicable under various conditions.

6. Process control, 3 sessions
These sessions will promote an understanding of the characteristics of systems characterized by dynamic input and parameter values and also briefly describe the control methods for compensating fluctuations by taking distillation column and reactors as examples.

7. Feedback, 1 session
Supplementary classes or exercises are conducted outside of the regular course schedule to confirm the achievement of learning objectives related to diffusion, gas absorption, and distillation.

[Course requirements]

Introduction to Industrial Chemistry (stoichiometry for chemical engineering), Foundations of Chemical Process Engineering

[Evaluation methods and policy]

Course grades will be based on the results of regular examinations and reports assigned as needed to improve understanding.

[Textbooks]

橋本，荻野 『現代化学工学』 (産業図書) ISBN:4782826095

[References, etc.]

（**Reference books**）
亀井編 『化学機械の理論と計算』 (産業図書)) ISBN:4782825099, 水科，桐榮 『化学工学概論』 (産業図書) ISBN:4782825102

[Study outside of class (preparation and review)]

Lectures will be conducted mainly using textbooks, and exercises will be assigned based on the pace of the lectures. Students should make efforts to acquire lecture content.

（Other information (office hours, etc.)）

Please visit KULASIS to find out about office hours.

*Please visit KULASIS to find out about office hours.

5. Gas-solid separation, 2 sessions
These sessions will describe the concept of partial separation efficiency, in addition to discussion of the principle of solid-gas separation and the methods for evaluating separation performance applicable under various conditions.

6. Process control, 3 sessions
These sessions will promote an understanding of the characteristics of systems characterized by dynamic input and parameter values and also briefly describe the control methods for compensating fluctuations by taking distillation column and reactors as examples.

7. Feedback, 1 session
Supplementary classes or exercises are conducted outside of the regular course schedule to confirm the achievement of learning objectives related to diffusion, gas absorption, and distillation.

[Course requirements]

Introduction to Industrial Chemistry (stoichiometry for chemical engineering), Foundations of Chemical Process Engineering

[Evaluation methods and policy]

Course grades will be based on the results of regular examinations and reports assigned as needed to improve understanding.

[Textbooks]

橋本，荻野 『現代化学工学』 (産業図書) ISBN:4782826095

[References, etc.]

（Reference books）
亀井編 『化学機械の理論と計算』 (産業図書)) ISBN:4782825099, 水科，桐榮 『化学工学概論』 (産業図書) ISBN:4782825102

[Study outside of class (preparation and review)]

Lectures will be conducted mainly using textbooks, and exercises will be assigned based on the pace of the lectures. Students should make efforts to acquire lecture content.

（Other information (office hours, etc.)）

Please visit KULASIS to find out about office hours.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 27401 LJ61　U-ENG27 27401 LJ76		
Course title (and course title in English)	化学プロセス工学［ＮＳ（工基礎）］ Chemical Process Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUSAKA SHIYUUJI Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,WATANABE SATOSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Chemical processes are comprised of a combination of various operations (unit operations), and this course will discuss distillation, gas-absorption, and other fluid-based mass transfer unit operations for separating and purifying substances, as well as mechanical unit operations related to the production and processing of particulate matter (powders), beginning from an overview of their basic phenomena and operating principles together with the study of the related kinetic phenomena and their quantitative expression methods. Students will also learn methods for the safe operation and control of chemical processes.

[Course objectives]

Cultivate an understanding of the concepts of mass balance, mass transfer, equilibrium relationship, and control by studying examples of typical separation operations, particle-based separation operations, and process control in chemical processes. In addition, students will develop the ability to quantitatively analyze chemical processes.

[Course schedule and contents]

1. Basics of substance separation and purification, 2 sessions
These sessions will explain the principles and methods of separation and purification of important substances in chemical processes, as well as the fundamentals of molecular diffusion and mass transfer.

2. Gas absorption, 2 sessions
Students will learn the concept of the “differential contact method”, through lectures discussing equilibrium of gas dissolution in liquids, the diffusion phenomenon in the liquid phase, gas absorption rates, and design methods for gas absorption devices.

3. Distillation, 3 sessions
These sessions will describe the correlation method of vapor-liquid equilibria, explain the basic principles of various distillation operation methods for mixed liquid purification procedures, and explain the design method for a continuous rectification stage column, which is the simplest “multi-stage contact operation.”

4. Overview of particle system operation, 2 sessions
These sessions will describe the role of particle-based unit operations in chemical processes, the evaluation of particle characteristics, their methods of expression, and the behavior of particles.

Continue to 化学プロセス工学［ＮＳ（工基礎）］(2)↓↓↓

Course number	U-ENG27 27402 LJ61　U-ENG27 27402 LJ76		
Course title (and course title in English)	基礎流体力学 Fundamental Fluid Mechanics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TANIGUCHI TAKASHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Lecture on fundamentals of fluid dynamics needed for Chemical Engineering

[Course objectives]

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

[Course schedule and contents]

Introduction to fluid dynamics, (3-times)
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, (6-times)
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’s equation of motion
4-4. Bernoulli’s theorem
4-5. Examples
4-6. Streaming function and potential flow
Dynamics of viscous fluid, (5-times)
5. Dynamics of viscous fluid
5-1. Viscosity
5-2. Stress tensor
5-3. Exact soluble problems described by Navier-Stokes equation

Continue to 基礎流体力学(2)↓↓↓

基礎流体力学(2)

Confirmation of the level of attainment, (1-time)
Confirmation of the level of attainment
Comments on the term-end Exam

[Course requirements]

It is highly recommended for students to take the class:
"Mathematics for Chemical Engineers I".

[Evaluation methods and policy]

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

[Textbooks]

日野幹雄 『流体力学』（朝倉書店）ISBN:4254200668

[References, 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)

[Study outside 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 a fundamental knowledge of vector analysis as prerequisite knowledge,
it is highly recommended for the students to parallelly take a class of "vector analysis".

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

化学工学計算機演習(2)

To qualify achievement of the practices

[Course requirements]

None

[Evaluation methods and policy]

Absolute evaluation based on the assignments with taking into account participation in practice classes, quizzes, and examination.

[Textbooks]

Ken'ichi Harada 『Fortran 77 Programming』（Saiensu (Science)）ISBN:9784781904610

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Practice of programming and calculations are to be carried out by BYOD. Train yourself at home as well as at classes.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG27 27403 LJ76 U-ENG27 27403 LJ61		
Course title (and course title in English)	化学工学計算機演習 Computer Programming in Chemical Engineering	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Tue.4	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Lectures and practices of fundamentals of computer algorithms and programming using FORTRAN 77 and Visual Basic for Applications (VBA) for learning basic knowledge and skills of computation required for chemical engineers. FORTRAN 77 has been often employed for numerical calculation and VBA is practical on PCs.

[Course objectives]

To learn syntaxes of FORTRAN 77 and VBA, how to write programs, and how to execute program for solving basic chemical engineering problems.

[Course schedule and contents]

Weeks 1--3: Computer algorithms and programming I
1) Introduction to digital computers and programming languages as well as inputs, outputs, and simple programs, 2) Logical IF statement and GO TO statement, data types, 3) Array and DO loop, 4) Description of assignments

Weeks 4--5: Practice of computer algorithms and programming I
To write and execute 2 or 3 programs solving fundamental problems. e.g. Simple calculations, integration by the trapezoidal rule, Newton method, bisection method

Weeks 6--8: Computer algorithms and programming II
1) Built-in functions, function and subroutine subprograms, 2) Data format, input from and output to file, 3) Interpolation, numerical integration, 4) Description of assignments

Weeks 9--11: Practice of computer algorithms and programming II
To write and execute 2 or 3 programs solving fundamental chemical engineering problems. e.g. Statistics, linear least square

Week 12: VBA programming
Fundamentals of Visual Basic for Applications and some examples of VBA codes

Weeks 13--14: Practice of VBA programming
To write and execute some VBA programs solving problems, some of which are shared with FORTRAN practice

Week 15: Qualification

Continue to 化学工学計算機演習(2)↓ ↓↓

Course number	U-ENG27 47997 GJ61		
Course title (and course title in English)	反応工学 I Chemical Reaction Engineering I	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview 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 objectives]

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,

[Course requirements]

It is required to learn Fundamentals of Chemical Process Engineering and to have basic knowledge of ordinary differential equations and matrix.

[Evaluation methods and policy]

Absolute evaluation based on the examination, assignments, and quizzes.

[Textbooks]

Kenji Hashimoto 『Han'no Kogaku (revised and augmented)』（Baifukan）ISBN:9784563046347

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Take home assignments almost every week.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46997 GB72		
Course title (and course title in English)	材料有機合成化学 Organic Material Synthetic Chemistry	Instructor's name, job title, and department of affiliation	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
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 39123 LJ10　U-ENG29 39123 LJ57		
Course title (and course title in English)	工業化学概論［工化2］ Introduction to Industrial Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MIYAHARA MINORU
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 工業化学概論［工化2］(2)↓↓↓

未更新

Course number	U-ENG29 39123 LJ10　U-ENG29 39123 LJ57		
Course title (and course title in English)	工業化学概論［工化1］ Introduction to Industrial Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MIYAHARA MINORU
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,2times,
,2times,
,2times,
,2times,
,2times,
,2times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

工業化学概論［工化2］(2)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 39123 LJ10　U-ENG29 39123 LJ57		
Course title (and course title in English)	工業化学概論［工化3］ Introduction to Industrial Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MIYAHARA MINORU
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 工業化学概論［工化3］(2)↓↓↓

未更新

Course number	U-ENG29 39123 LJ10　U-ENG29 39123 LJ57		
Course title (and course title in English)	工業化学概論［工化4］ Introduction to Industrial Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MIYAHARA MINORU
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 工業化学概論［工化4］(2)↓↓↓

工業化学概論［工化3］**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

工業化学概論［工化4］**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG20 32402 SE77		
Course title (and course title in English)	高分子化学序論 Introduction of Polymer Chemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,AKIYOSHI KAZUNARI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

Chem-E-Car設計・実験(2)

[Textbooks]

教員が配布するプリント

[References, etc.]

（**Reference books**）
アトキンス『物理化学（上）　第10版』

[Study outside of class (preparation and review)]

授業中に指示する

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

Course number			
Course title (and course title in English)	Chem-E-Car設計・実験 Chemical-E-Car Design and Experiment	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SANO NORIAKI Faculty of Engineering

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.4,5	Class style	Practical training	Language of instruction	Japanese

[Overview 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 objectives]

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

[Course requirements]

None

[Evaluation methods and policy]

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。

Continue to Chem-E-Car設計・実験(2)↓↓↓

未更新

Course number	U-ENG29 29007 LJ10　U-ENG29 29007 LJ72		
Course title (and course title in English)	特別研究（H18年以降入学者） Graduation Thesis	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF

Target year	4th year students or above	Number of credits	12	Year/semesters	2020/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

いずれかの研究室に配属され、工業化学全般に関する各自のテーマについて研究を進め、学士論文を作成する。

[Course objectives]

研究テーマに関する議論・討論・実験演習を通じ、研究課題抽出・問題解決などの研究能力を得るとともに、学術的・技術的内容を明確に説明するコミュニケーション能力を高める。

[Course schedule and contents]

指導教員と協議のうえ決定する。
例えば、週２コマ程度のゼミと週１回以上の個別課題検討など。

[Course requirements]

特別研究を開始するためには、入学年度に基づく「研究室配属・特別研究着手に必要な単位数」を満たし、研究室に配属している必要がある。

[Evaluation methods and policy]

研究課題に対する理解度・演習の実施状況、学士論文に対する口頭試問に基づき、総合的に評価を行う。

[Textbooks]

各研究室で指示する

[References, etc.]

（**Reference books**）
各研究室で指示する

[Study outside of class (preparation and review)]

研究テーマに応じて自主的に学習することが求められる。

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.