Course number U-ENG20 42105 LJ77	工学倫理(2)
Course title (and course title in English) 工学倫理 English) Graduate School of Informatics Professor,KANDA TAKAYUKI Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Professor,SHIRAISHI MASASHI Graduate School of Engineering Professor,SHIRAISHI MASASHI Graduate School of Letters Associate Professor,KODAMA SATOSHI Graduate School of Letters Associate Professor,KODAMA SATOSHI Graduate School of Letters Associate Professor,KODAMA SATOSHI Graduate School of Letters Professor,MATSUSAKA SHUJI Graduate School of Letters Associate Professor,MATSUSAKA SHUJI Graduate School of Engineering Professor,MATSUSAKA SHUJI Graduate School of Engineering Professor,MATSUSAKA SHUJI Graduate School of Engineering Professor,KODAMA SATOSHI Graduate School of Engineering Professor,MATSUSAKA SHUJI Graduate School of Engineering Professor,TATSUSAKA SHUJI Graduate School of Engineering Professor,TADA SAYUKI Graduate School of Engineering Professor,TADA JASHI Graduate School of Engineering Professor,MARAI JIYUN Office Josciet-Audami Collabotation fenuovation NAKAGAWA MASAYUKI Graduate School of Engineering Professor,MURA MASAYUKI Graduate School of Engineering Professor,MURA KEN Graduate School of Engineering Pr	 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. This Lecture will be conducted online by using zoom. (5/6) "Engineering Ethics as a Professional Ethics:" This lecture discusses basic ideas of engineering ethics in comparison with other fields of applied ethics. In particular, it discusses the characteristics of engineering ethics as professional ethics and what engineers as professionals are required to do. (5/13) "Ethics for Engineers" Engineers have to go through some ethical issues about research, development, design, manufacturing, and maintenance. In particular, the ethical decisions of engineers need to be considered for society and environment. (5/20) Press Release is an essential process for introducing the research to our society through various medias. In this lecture, issues related to Press Release will be addressed and discussed with several examples including SNS release. Lecture will be conducted by Zoom. (5/27) "Ethics in Water Supply." It is a basic right in a society that a person can receive and use safe water in sufficient quantity. In addition, a person of water supplier and an engineer is discussed. It is given by Zoom. (6/3) "Forensic Analysis" Forensic repots are sometimes requested by the court in order to clarify the charge of incidents. The nylon rope incident, the Wakayama curry poisoning incident, and the pig iron incident are explained as examples. How to write the forensic report is explained in order to avoid the ethical problems. (Zoom& Youtube) (6/10) "Patents and Ethics (Part 1)" 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
Target year 4th year students or above Number of credits 2 Year/semesters 2021/First semester	actual case studies on ethical and legal issues in patents. (6/24) "Urban Planning and Ethics"
Days and periods Thu.3 Class style Lecture Language distriction Japanese	The lecture focuses on the norms regulating the actions of the engineers involved in planning and designing urban areas, as well as on the normative consciousness required to facilitate such planning and design,
[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] (4/8) The central topic is what is ethics for engineers and what is significance of studying ethics for engineers. (4/15) "General research ethics" Lectures on the concept of writing academic papers with ethics. (4/22)" Ethical Theories for Engineering Ethics" Continue to T学倫理(2)↓↓↓	 demonstrating some examples on urban transport planning. This will be given via Zoom. (7/1) "General research ethics of synthetic chemistry" Lectures on the concept of writing academic papers and patents of synthetic chemisty with ethics. (7/8) Architecture has developed by imitating beautiful buildings, but in recent years there has been an increase in the number of cases where copyright disputes have arisen. In addition, the appearance of architecture often causes landscape controversy because of its influence on the surrounding environment. Issues concerning the ethics and sociality of architecture are discussed while introducing overseas lawsuits and design processes. (7)15) The materials engineer may stand on the side using materials as well as a side supplying materials. Some examples are introduced and, by this lecture, are argued about an ethic found from each situation by materials engineer. Note that this lecture is going to be carried out in ZOOM, but may be changed to the ondemand on account of the speaker. (7)29) "Engineer ethics in mechanical design" Engineer ethics is not a passive and passive thinking that issues the action of simply following existing norms, but a more active and creative thinking to decide and design noe's own actions. It requires the logical thinking and ethical thinking necessary for engineers. This is explained with past cases in mechanical design.
工学倫理(3)	
L 子倫理(3) [Course requirements] None [Evaluation methods and policy] Class participation and reports. [Textbooks] Lecture materials will be distributed. [References, etc.]	Course number U-ENG20 12108 LJ77 Course itile (and course itile English) U-ENG20 12108 LJ77 Course itile (and course itile in English) U-ENG20 12108 LJ77

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[References, etc.] (Reference books)

[Engineering Ethics (Revised Edition)] (CORONA PUBLISHING CO., LTD.) ISBN:978-4-339-07798-

[World of Engineering Ethics (3rd Edition)] (Morikita Publishing Co., Ltd.) ISBN:978-4-627-97303-9

[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]

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

Graduate School of Engineering Professor,HIKIHARA TAKASHI

Graduate School of Engineering Professor, KAWASE MOTOAKI Graduate School of Inform

Year/semesters 2021/Intensive, First semester

Language of instruction Japanese

rofessor, YAMASHITA NOBUO

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 ontent and opinions of other students. content and opinions of other students. Schedule of the lectures are announced later.

Special lectures, l time, About basic knowledge and attitude as students who start to learn engineering, and the nole of engineering in society. Intensive lectures,6times, A series of lectures offered by special lecturers playing on global stages of science

Continue to 工学序論(2)↓↓↓

1 st year students or above Number of credits 1

Lecture

Engineering is to inquire after truth, to develop useful technologies, and to establish ways how to give back

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

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

First, we offer special lectures regarding the basic knowledge that students in faculty of engineering are

Class style

Target year

expected to have.

are expected to fulfill.

[Course objectives]

[Course schedule and contents]

safety and security.

Days and periods Intensive

[Overview and purpose of the course]

evelopment results of technology to the society

Course number U-ENG20 32402 SE77
Course title Instructor's
(and course) 工学部国際インターンシップ 1 name, job title, title in Faculty of Engineering International Internship 1 and department Approved
English) of affiliation
Target year Brd year students or above Number of credits 1 Year/semesters 2021/Intensive, year-ro
Days and periods Intensive Class style Seminar Language distriction Japanese and Engl
[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 t
[Course objectives] The acquisition of international skills with the training of foreign language through the to internship prog
hosted by the University is the major expectation to the students.
[Course schedule and contents]
Overseas Internship, Itime, The contents to be acquired should be described in the brochure of each intern program.
Final Presentation, Itime, A presentation by the student is required followed by discussion among particip
[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 Departmen
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 granter
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 participate
[Textbooks]
Course number U-ENG20 22403 SJ77
Course title Instructor's Graduate School of Engineerin
Course title (and course title in English)
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Course title (and course) title in English) Course title (and course) Global Leadership Seminar I (Study for methodology in a company) Global Leadership Seminar I (Study for methodology in a company) Target year Days and periods Intensive Class style Class style Class style Class style Seminar Course in the international market. Throughout hands-on training on their laboratory, students in capability. As extended exersive subject of this course, the Global Leadership Seminar II is opened in the second semiser. Course objectives]
Course title (and course title in English) Graduate School of Engineerin Gabal Leadership Semimar I (Study for methodology in a company) Target year and year students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students or above Number of credits I Year/semesters Course with the students investigate the methodology of team organization, proposal, market prediction and conception ability by group works. After the investigation, students are expected to improt their comprehension and explanation capability. As extended exersice subject of this course, the Global Leadership Semimar II is opened in the second semester. Course objectives T The goal of this course is to improve student's comprehension and explanation capability for processes or proposal and expansion on the international market investigating worldwide leading companies by group
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Course time: Instructor's Graduate School of Engineerin Senior Lecturer, YOROZU KAZ Graduate School of Engineerin Senior Lecturer, KOMIYAMA YO Target year Ind year students or above Number of credits 1 Year/semesters 2021/Intensive, year-r Days and periods Intensive Class style Seminar Image disturt Japanese [Overview and purpose of the course] The purpose of this course is to study about how worldwide leading company, institute, etc. make propose and find solutions for expanding their own technologies to the international market. Throughout hands-ctraining on their laboratory, students investigate the methodology of team organization, proposal, marke prediction and conception ability by group works. After the investigation, students are expected to impretheir comprehension and explanation capability. A sextended 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 expansion on the international market invesitigating worldwide leading companies by grow work. [Course schedule and contents] Week 1, Guidance Evaluation methods and policy] Week 14, Pre-presentation Evaluation methods and policy] Students are prohibited to skip hands-on traini

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コーバル・リーダーシップセミナー1(企業調査研究) (2)	Course number U-ENG20 32502 SE77
leferences, etc.]	Course title Instructor's
Reference books)	(and course) 工学部国際インターンシップ2 title in English) Faculty of Engineering International Internship 2 Approved
Related URLs)	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Intensive, year-relation
//www.glc.t.kyoto-u.ac.jp/ugrad	Days and periods Intensive Class style Seminar Language distructor Japanese and Eng
udy outside of class (preparation and review)]	[Overview and purpose of the course]
stigating companies in advance. Analyzing the result from hands-on training. Preparing presentation.	Acquisition 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.
ther information (office hours, etc.)) v to register will be announced later. Students who want to join this course is requested to attend the first	[Course objectives]
S. Students are prohibited to skip hands-on training. Evaluation will be based on presentation.	The acquisition of international and foreign language skills through the participation to international
ase visit KULASIS to find out about office hours.	programs is expected. Detailed objectives of the participation should be identified by each program.
urses delivered by instructors with practical work experience]	[Course schedule and contents] Overseas Internship, 1 time, The contents to be acquired should be described in the brochure of each inter
ategory mnibus course delivered by invited lecturers and guest speakers from different companies, etc.	program. Final Presentation, Itime, A presentation by the student is required followed by discussion among partici
etails of instructors' practical work experience related to the course	
	[Course requirements]
Details of practical classes delivered based on instructors' practical work experience	Described in the application booklet for each internship program. The registrant is requested to have enclanguage skills for the participation.
	[Evaluation methods and policy] Marit rating is done based on the presentation or reports after each internship program. Each Departme
	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 as the second
	the Global Leadership Education Center as a optional credit. The number of credits, either 1 or 2, will b determined depending on the contents and the duration of the program that the participant has participant
	[Textbooks]
	Continue to 19 mais 177 77772
全部国際インターンシップ 2 (2) Sferences, etc.]	(and course グローバル・リーダーシップセミナーII(イノベーションとその事業化) name, job title, Senior Lecturer, KANEKO KENT
ferences, etc.]	Course title (and course) title in English) Global Leadership Seminar II (Imovation and is commercialization) Global Leadership Seminar II (Imovation and Is commercialization)
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a goal is made through presentation of the proposal as well as a submitted report. [Textbooks] Will be indicated as necessary.	Course title (and course) Fötter (and course) Instructor's name, job title, name, job title, Graduate School of Engineering Professor, TANAKA TSUNEHIRO Graduate School of Engineering Professor, OCE KOUICHI
[References, etc.] (Reference books) Will be indicated as necessary.	title in English) Industrial Organic Chemistry and department of affiliation Graduate School of Engineering Professor, ATOMI HARUYUKI Graduate School of Engineering Professor, KAWASE MOTOAKI Graduate School of Engineering Professor, KONDOU TERUYUKI
[Study outside of class (preparation and review)]	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester
Will be indicated as necessary.	Days and periods Wed. 1 Class style Lecture Language distruction Japanese
(Other information (office hours, etc.))	[Overview and purpose of the course]
Course open period: October to January	In petrochemistry, organic intermediates are synthesized highly efficiently using a reaction that is completely different from that described in textbooks on organic chemistry. High efficiency means having low
*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.	consumption of energy and resources, and a low environmental impact. Lectures will discuss the current state of industrial organic chemistry and reference manufacturing processes centered on petrochemistry and fermentation.
*Please visit KULASIS to find out about office hours.	[Course objectives]
[Courses delivered by instructors with practical work experience]	To understand the current state of the organic chemical industry based on the current economic climate, and to understand the characteristics of large-scale chemical product manufacturing and the basics needed to
(1) Category	maintain its processes.
(2) Details of instructors' practical work experience related to the course	[Course schedule and contents] Current state of carbon resources, history of the organic chemical industry, and the use of natural gas, 2
(3) Details of practical classes delivered based on instructors' practical work experience	sessions Students are given an overview on the current state of carbon resources such as petroleum, coal, natural gas, and biomass, as well as on the future outlook of energy supply and demand and the properties of carbon resources. Following this, the history of industrial organic chemistry is outlined alongside the chemical utilization of natural gas and utilization of biomass, which are expected to become increasingly important in the future. [Mae professor]
	Petroleum products, petroleum refining, steam cracking, 2 sessions The properties required for the safe use of petroleum products such as gasoline, kerosene, and light oil are outlined, along with chemical processes such as desulfurization, decomposition, and reforming, which are required to produce petroleum products. Following this, students are given an overview of the synthesis of ethylene, propylene, and BTX, which are the main materials in petrochemistry, and are taught the methods by which each product is isolated from complex mixtures (distillation, extractive distillation). [Professor Kondo]
	Oxidation reactions and acid catalyst reactions, 3 sessions Students are given a general overview of the characteristic reactions of petrochemistry that use air as an

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oxidant and are taught about the characteristics of catalysts that enable such reactions. In addition, special oxidation reactions such as ammoxidation, acetoxylation, and oxychlorination are explained, before briefly overing dehydrogenation reactions and oxidative dehydrogenation reactions. Following this, acid catalyst actions such as esterification reactions, aromatic alkylation reactions, and hydration reactions are then utlined, alongside the characteristics of solid acid catalysts. [Professor Tanaka (Tsune)]

Chemistry of olefins, aromatic compounds and petrochemical secondary derivatives, 2 sessions The conversion reactions of aromatic residues known as ethylene, propylene, C4 olefins, and BTX are explained using specific examples of each. In addition, students are taught industrial organic chemistry of condary derivatives made from materials such as ethylene oxide, acetaldehyde, and acetone. Following this he synthesis of chemical products from BTX secondary derivatives is summarized. [Professor Ohe]

ogeneous catalytic reactions, 1 session

After giving an overview of complex catalysts, students are taught about processes of acetic acid synthesis sing complex catalysts (Wacker process, oxo process, and Monsanto process). In addition, students briefly buch on the topic of complex-catalyzed asymmetric synthesis that uses cross-coupling reactions, alkene tetathesis reactions, and chiral ligands. [Professor Ohe]

ioprocesses, 2 sessions

An overview is given on the industrialized fermentation process and its principles. In addition, while using specific examples, students are taught basic strategies and methods for screening microorganisms and enzymes, enhancing activity, improving selectivity, regenerating coenzymes, and removing feedback inhibition, etc., which are needed for the commercialization of bioprocesses. [Professor Atomi]

Flow sheets and material balances, 2 sessions

Flow sheets and material balance sheets are the most important materials when it comes to chemical processes. Therefore, students are taught how to read outline flow sheets used in loctures or dimensional are students are taught how to read outline flow sheets used in loctures and are given a brief explanation on detailed flow sheets. In addition, students are taught the basics of stoichiometry, as well as key oints in reading and preparing detailed material balance sheets. [Professor Kawase]

Feedback lecture, 1 session

Lectures and examination contents are explained to students to improve their degree of learning (details are given during lecture or on KULASIS). [All professors]

[Course requirements]

Lectures are given under the assumption that students have taken "Organic Chemistry: Fundamentals and Exercises" and "Fundamentals of Chemical Process Engineering," which are offered in the first half of Exercises the second year

[Evaluation methods and policy]

Questions on an end-of-term examination are given by all professor, with marks alloted to the questions being proportional to the total lecture time of each professor. The final grade is determined mainly by students' results on the end-of-term examination, and to a smaller degree, their performance in teaching sessions.

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[Textbooks]

Others; materials are distributed during each lecture.

[References, etc.] (Reference books)

(Reference DOORS) The following are to be distributed during the first lecture: Kambe, N., Yasuda, M. (ed.), Gendai yuuki kougyou kagaku, (Kagaku-Dojin Publishing, 2020) ISBN: 978-4-7598-2025-6; Tajima, K., Fukawa, I. (trans.), Kougyou yuuki kagaku, (Tokyo Kagaku Dojin, 2016) ISBN: 978-4-8079-0876-9; Wittorf, H.A., Reuben, B., Plotkin, J.S., Industrial Organic Chemicals, 3rd Ed., (Wiley, 2012) ISBN: 9780470537435; Konishi, S., Nenryou kougaku gairon, (Shokabo, 1991) ISBN: 00097241; Japan Petrochemical Industry Association (ed.), Sekiyu kagaku kougyou no genjou 2021-nen, (Japan Petrochemical Industry Association, 2021)

[Study outside of class (preparation and review)]

Before attending teaching sessions, it would be advisable for students to read reference books to acquire knowledge on the formation and current state of the petrochemical industry in 2021. In addition, students will deepen their comprehensive understanding of industrial organic chemistry and their knowledge on process technology and other matters by reviewing materials distributed during teaching sessions and answering questions on short tests conducted in each teaching session. It would also be advisable for students to devote wice the amount of time spent in teaching sessions to review and prepare for the next session.

(Other information (office hours, etc.))

A small test may be given before the end of lectures

*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

Course n	umber	U-ENG27 3703	0 LJ61			未更新	生物化学工学(2)
Course title (and course title in English)	生物化学			Instructor's name, job title, and department of affiliation	Professor,A Graduate Sc Professor,H Graduate Sc Program-Specific Ass Graduate Sc	hool of Engineering FOMI HARUYUKI hool of Engineering AMACHI ITARU hool of Engineering weite Professor, TAKAHASHI NOBUAKI hool of Engineering er, TAMURA TOMONORI	(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.
arget yea	ar 3rd year	students or above Nu	mber of cred	lits 2 Yea	ar/semesters	2021/Second semester	[Courses delivered by instructors with practical work experience]
Days and peri		Class st	-	e	Language of instructio	Japanese	 Category A course with practical content delivered by instructors with practical work experience
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[Course of	bjectives]						(3) Details of practical classes delivered based on instructors' practical work experience
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[Evaluatio	on method	s and policy]					
[Textbool	ks]						
[Reference (Refere	ces, etc.] nce books)					
[Study ou	Itside of c	ass (preparati	on and revie	w)]			
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Course nu	Imber	U-ENG	327 37	7042 LJ61							
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Target yea	r Brd y	ear students o	r above	Number	of cred	its	2	Yea	r/semesters	2021/First se	mester
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[Course s	chedule	e and co	ntent	s]							
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4. Aquatic Environment, 2 times

4. Aquate 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]

on

[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.

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未更新	環境安全化学(2)
Course number U-ENG27 37043 LJ61	
Course title Instructor's Agency for Health, Safety and Environment Professor, HASHIMOTO SATOSHI	
(and course 環境安全化学 name, job title, Graduate School of Engineering	[Study outside of class (preparation and review)]
title in English) Chemistry and Environmental Safety and department of affiliation Associate Professor,NAKAGĀWA HIRŎYUKI Graduate School of Engineering	
Professor,ABE RYUU	
Farget year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester	(Other information (office hours, etc.))
	*Please visit KULASIS to find out about office hours.
Days and periods Thu. 1 Class style Lecture Language distution Japanese	
[Overview and purpose of the course]	[Courses delivered by instructors with practical work experience]
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	A course with practical content delivered by instructors with practical work experience
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Continue to 環境安全化学(2) ↓ ↓	
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(and course title in English)		ス制御工 S Control	学		Instructor name, job and depar of affiliation	title, tment	Professor,OC Graduate Scl	hool of Engineering OSHIMA MASAHIR hool of Engineering OTOWA KENICHIR(
Target yea	r Brd	year students o	or above Number	of cred	lits 2	Yea	r/semesters	2021/First semester
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[Course s			•	g several	examples	, the ne	cessity, object	tives and importance of
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プロセス制御工学(2)	プロセス制御工学(3)
Mid-term exam, 1 time, To know the level of understanding, the mid-term examination is conducted.	
Frequency response, I time, The relationship between the sine wave input and the output (the frequency	[Courses delivered by instructors with practical work experience]
response), and how to detect the stability from the frequency response are lectured. The features of various	(1) Category
filters are also explained.	
PID control system design, 1 time, 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.	(2) Details of instructors' practical work experience related to the course
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.	(3) Details of practical classes delivered based on instructors' practical work experience
Cascade control and Multi-loop control, 1 time, The concept of cascade control is explained. Then, as a control	(5) Beans of practical classes derivered based on instructors – practical work experience
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, 1 time, [Exercise] For a given process, the exercise of developing a controller	
for a two-input and two-output process is executed.	
Equipment for control, 1 time, 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, 1 time, [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}	
79-5	
[References, etc.]	
(Reference books) Process Control System, Ohshima, CORONA Publishing isbn{} {4339033146}	
Process Control System, Olisininia, CORONA Publishing Ison { } {4535035140 }	
[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)↓↓↓	

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[References, etc.] (Reference books)

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

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 | iate Professor,KURAHÄSHI T.
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citate Professor,HIROSE TA
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媒化学(2)	Course number U-ENG27 37064 LJ61
hat is photocatalsys; principle of photocatalysis; photocatalysis in next generation; green chemistry; what is wironmental catalyst? Catalyst preparation mmethod (2) rmation of precipitates; structural change in drying process; co-precipitation method; uniform precipitation	Course title (and course title in English) 生化学II Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor, ATOMI HARUYUKI Graduate School of Engineering Professor, MOMI YASUO Graduate School of Engineering Professor, HAMACHI ITARU
ethod; hydrothermal method; sol-gel method; sorvothermal method.	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester
Summary of last half part of the lecture (1)	Days and periods Mon.1 Class style Lecture Language of instruction Japanese
lution of quizzes and summary	[Overview and purpose of the course]
). Feedback (1)	
Course requirements]	
one	[Course objectives]
Evaluation methods and policy]	
otal scores of quizzes performed after first and last half of the lecture are evaluated.	[Course schedule and contents]
[extbooks]	3times.
ot used	,3times, ,2times, ,2times, ,2times,
References, etc.]	,2times,
(Reference books) troduced during class	,1time, ,4times,
	[Course requirements]
Study outside of class (preparation and review)]	None
eview the documents supplied in lecture.	[Evaluation methods and policy]
Other information (office hours, etc.))	
rst half of the lecture will be given by Prof. Tanaka and the rest by prof. Abe.	
Please visit KULASIS to find out about office hours.	[Textbooks]
Courses delivered by instructors with practical work experience]	
) Category course with practical content delivered by instructors with practical work experience	
) Details of instructors' practical work experience related to the course	
) Details of practical classes delivered based on instructors' practical work experience	
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生化学॥(2)	Course number
[References, etc.]	Course title
(Reference books)	(and course 微粒子工 ² title in Fine Partic English)
[Study outside of class (preparation and review)]	Target year Brd year
	Days and periods Tue.3
(Other information (office hours, etc.))	[Overview and purp
*Please visit KULASIS to find out about office hours.	From raw materials to f processes. In this cours powders, properties of and the generation, sep
[Courses delivered by instructors with practical work experience]	[Course objectives
 Category A course with practical content delivered by instructors with practical work experience (2) Details of instructors' practical work experience related to the course 	Students will acquire an analyzing the dynamic developments involving collection.
	[Course schedule a
(3) Details of practical classes delivered based on instructors' practical work experience	Overview of fine-partic Explanation is made of processes and natural p Particle properties and i In these lectures, explan size distribution and rel of elastic deformation a capillary condensation, relationship between lin particles, and the chara methods for these will i Gas (vapor)-phase parti Lectures focus on the b of gas-phase dispersed surface deposition, fine various operations, incl Liquid-phase particle sy Explanation is made of operations including di particle group interactit understood the contents

	Course number U-ENG27 37070 LJ61 U-ENG27 37070 LJ76								
Course title (and course title in English)	エ学 article Technolo	ogy	na ar	structor's ame, job tit ad departm affiliation	nent	Graduate School of Engineering Professor,MATSUSAKA SHUJI Graduate School of Engineering Associate Professor,WATANABE SATO			
Target year Brdy	year students or abo	ve Number o	of credits	2	Year	/semesters	2021/Second semester		
Days and periods Tue.	.3 Cla	ss style	Lecture			Language of instruction	Japanese		
[Overview and p	urpose of the	e 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 objectiv	/es]								
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 schedul	le and conter	nts]							
Overview of fine-pa Explanation is made processes and natura	e of the role of	fine engineer	ing in che	mical pro	cesses	, with examp	les from classical		
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.									
Lectures focus on th of gas-phase dispers surface deposition, f	he basics of mid sed particles. E fine particle ag	croparticle ge xplanation is gregation, etc	made of a . Using th	nalysis m is as a fo	ethods undation	s for basic pho on, discussior	on, as well as motion enomena such as wall- h is then made of		

微粒子工学(2)	Course nu	mher U-	ENG27 37071 LJ	61 U-ENG27 370)71 LJ76		
General summary of course (1 class)	Course title (and course	プロセスシス	ステム工学	Instructe name, jo	ob title,		hool of Engineering DTOWA KENICHIR
A summary, chiefly focused on dry powder operations.	title in English)	Process Syste	ms Engineering	and dep of affilia			hool of Engineering ssor,TONOMURA OSA
[Course requirements]	Target year	Brd year stud	lents or above Numb	er of credits 2	Yea	r/semesters	2021/Second semes
None	Days and perio	de Thu 2	Class style	Lecture		Language of instruction	Japanese
[Evaluation methods and policy]			se of the course			Language of manufactor	Japanese
Evaluation is made on the basis of scores (results) in periodically given tests. Consideration will also be given o reports that may be assigned at any time during the course. [Textbooks]	The chemica optimal synth	l processes co	onsist of various un design and produc	nit operations. In th			and the methods of nematical methods for
K. Okuyama, H. Masuda and S. Morooka Biryuushi Kougaku ndash Fine particle technology (Ohmsha)	<u> </u>		amed.				
SBN:4-274-12900-4	[Course of				1 0.		2 1 11
	for chemical	processes. In	addition, it is requ		d the opti	mization meth	operational problems nods for solving the problem.
[References, etc.]	Ĺ			,			
(Reference books) K. Hashimoto, F. Ogino 『Gendai Kagaku Kogaku』 (Sangyo Tosho) ISBN:4-7828-2609-5	-	chedule and		avatama annina.	a ia 1	ainad	
Crimoninovo, r. ognio – Ociruai Ragaku Rogaku (Odligyo 10810) 15DIN-+-7626-2007-5	Modelling of		s -physical model,	systems engineerin 1time,The feature of			I in the process design
[Study outside of class (preparation and review)]	Modelling of	f the processes	s - statistical mode	el,1time,The least s	quare me	thod used in c	onstructing the
Students must prepare for classes, and review after classes.		del is explain process desig		edure of process de	sign and	the solution m	nethod using input an
(Other information (office hours, etc.))	output model	l are explained	d.		-		
Please visit KULASIS to find out about office hours.		gn using simu llators is expla		sequential modular	approach	which is com	monly used in the
Please visit KULASIS to find out about office hours.	Process synth	hesis,1time,Tl	he combinatorial p		od and m	ulti-step heuri	stic method which are
			ign are explained.		is metho	l using T-O di	agram is explained fo
	the heat exch	nanger networ	k synthesis proble	em.			
		nanagement o problem is ex		ses,1time,The conc	ept of pro	oduction mana	gement including
				mulation of the pro	duction r	lanning probl	em as a linear
	programming	g problem, an	d its solution meth	nod using the simple	ex metho	d are explaine	d.
				times, The formulat			roblem of batch and bound method a
	explained.	a uavening sa	iesinan problem a	nd its solution proc	coure usi	ng the branch	and bound method a
				sses,1time,Various	scheduli	ng problems v	which arise in batch
			n methods are exp ievement, 1 times	The comprehensiv	e review	is executed, a	nd the
			omework is explai			,	
						Continue to 7	コセスシステム工学(2)↓
						Continue to 71	1℃、2、7、7,4⊥子(2)↓
プロセスシステム工学(2)	Course nu	mber U-	ENG27 47072 LJ	76 U-ENG27 470)72 LJ61		
[Course requirements]	Course title (and course	プロセス設計	+	Instructo name, jo		Graduate Sci Professor Sci	hool of Engineering DTOWA KENICHIR
The basic knowledge of chemical engineering such as the unit operation and reaction engineering, and that of	title in	Process Desig		and dep	artment	Faculty of E	
ifferential and integral calculus are requested.	English)			of affilia	uon		
Evaluation methods and policy]	Target year	4th year stud	lents or above Numb	er of credits 2	Yea	r/semesters	2021/First semester
omework assigned in the lectures is treated as 30 points, and the final examination is treated as 70 points of total score.	Days and perio		Class style	Lecture		Language of instruction	Japanese
Textbooks]			se of the course			1	
Lecture materials are distributed in the class.	-			igning chemical pr	ocesses v	which consist of	of various unit
	operations. A	A conceptual d		a chemical process			
[References, etc.]	[Course of	pioctives]					
(Reference books)	-		nd the way of con-	ceptual design, and	to have f	he skill of des	igning chemical
				mical engineering a			
(Study outside of along (proportion and review))	10	hodula	a antontal				
[Study outside of class (preparation and review)]	LCourse so	chedule and	contents				

[Study outside of class (preparation and review)] Students must be familiar with material and energy balances. Understanding of linear algebra is also required.

(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

_____ Continue to プロセス設計(2)↓↓↓

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, l time, 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.

Similators is explained. Then, now to use process similation is explained using the demonstration. Reality of process design, folimes, 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

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

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

explained. (Intensive course)

[Evaluation methods and policy]

the faculty attend.
[Course requirements]

プロセス設計(2)	Course number U-ENG27 37082 LJ76 U-ENG27 37082 LJ61
[Textbooks] The reference materials are prepared by teachers.	Course title (and course title in English) Computers in Chemical Engineering English) Computers in Chemical Engineering English)
[References, etc.] (Reference books) Introduced during class	Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester Days and periods Tue.3 Class style Lecture Language distudent Japanese [Overview and purpose of the course] Televice Language distudent Lecture Language distudent Language distudent
(Related URLs) (http://www.cheme.kyoto-u.ac.jp/processdesign/)	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
[Study outside of class (preparation and review)]	square method for parameter fittings [Course objectives]
(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.	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]
*Please visit KULASIS to find out about office hours. [Courses delivered by instructors with practical work experience]	I. Orientation After the instruction on how to start the VBA Editor, the students write the programs for basic arithmetic calculation and unit conversion.
 (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 	 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.
(3) Details of practical classes delivered based on instructors' practical work experience	 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)↓↓↓
計算化学工学(2)	Course number U-ENG27 47096 LJ61
data by non-linear least square method. 15. Term-end examination 16. Feedback	Course title (and course 化学実験の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安全指針 の安子 の安子 の の の の の の の の の の の の の の の の
[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	title in English) Safty in Chemistry Laboratory and department of affiliation Graduate School of Engineering Associate Professor,SUGASE KENJI Institute for Chemical Research Associate School of Engineering Senior Lecturer,JSHIDA NAOKI
be evaluated for the rest of the 60 % of the final grade.	Target year Hth year students or above Number of credits 1 Year/Semesters 2021/Intensive, First semester
[Textbooks] Text will be prepared by the tutors	Days and periods Intensive Class style Lecture Language distructor Japanese [Overview and purpose of the course]
[References, etc.] (Reference books) Introduced during class	[Course objectives]
[Study outside of class (preparation and review)] Writing program for the chemical engineering problem is assigned as homework every week.	[Course schedule and contents]
(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.	,ltime, ,ltime, ,ltime, ,ltime,
*Please visit KULASIS to find out about office hours.	.ltime, ,ltime, [Course requirements]
	None [Evaluation methods and policy]
	[Textbooks]
	[References, etc.] (Reference books) Continue to 化学実験の安全指针(2)↓↓↓
	Continue to 1L子天秋の女王指卸(2)↓↓↓

学実験の安全指針(2)	Course nu	mber	U-ENG2	27 37101 LJ61	U-EN	327 37101	LJ76		未更新
tudy outside of class (preparation and review)]	Course title (and course title in English)		学シミュレ ons in Cher	ーション nical Enginee	ring	Instructor's name, job t and depart of affiliation	itle, P ment (Professor,YA Graduate Scl	nool of Engineering MAMOTO RYOI nool of Engineering ssor,WATANABE SAT
	Target year	Brd ye	ear students or a	bove Number	of cred	its 2	Year/s	semesters	2021/Second sem
Other information (office hours, etc.))	Days and perio			lass style				Language of instruction	Japanese
ease visit KULASIS to find out about office hours.				the course]	Lecture	;		Language of instruction	Japanese
ourses delivered by instructors with practical work experience]	_								
Category ourse with practical content delivered by instructors with practical work experience	[Course o	ojective	es]						
Details of instructors' practical work experience related to the course	10	- la a de da		a mán 1					
Details of practical classes delivered based on instructors' practical work experience	[Course so ,3times, ,1time, ,2times, ,1time, ,1time, ,1time, ,1time,	inedule		lents]					
	[Course re None [Evaluatio			olicy]					
	[Textbook	3]							
							<u>-</u>	ntinue to 化学	ี IŸシミュレーション(2
									未更
学工学シミュレーション(2)	Course nu	mber	U-ENG2	27 27102 LJ60)				
eferences, etc.] Reference books)	Course title (and course title in English)			演習 [工化1 indamentals and] Exercises	Instructor's name, job t and depart of affiliation	itle, F ment	Professor,KO Graduate Scl	nool of Engineerin OGA TSUYOSHI nool of Engineerin essor,KOJIMA HIRO
						_	-		

*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

Course nu	umper	U-LIN	32/2	7102 LJ00						
Course title (and course title in English)				習 [工化1] mentals and H		nan and	tructor's ne, job ti I departn affiliation	tle, nent	Professor,KC Graduate Scl	nool of Engineering DGA TSUYOSHI nool of Engineering sssor,KOJIMA HIROYUKI
Target yea	ear 2nd year students or above Number of credits 2 Year/semesters 2021/First semester									
Days and periods Tue.2 Class style Lecture Language distruction Japanese										
[Overview	/ and p	ourpose o	f the	course]						
[Course o	bjecti	ves]								
[Course s	chedu	le and co	nten	ts]						
,3times,										
,3times, .4times.										
.2times.										
.2times.										
,1time,										
[Course re	oquiro	montel				_				
None	equire	mentaj								
[Evaluatio	on met	hods and	polie	cy]						
[Textbook	(s]									
[Referenc	es, etc	c.]								
Referer	nce bo	ooks)								
									ontinuo to mm/	学基礎及び演習[工化1](2)↓↓↓
								6	onunue (0 初哇化	子埜啶仄∪"洪自〔⊥1[〕1](2)↓↓↓

物理化学基礎及び演習 [工化1](2)	
物理化子嘧啶及び與自己工化1](2)	Course number U-ENG27 27102 LJ60
[Study outside of class (preparation and review)]	Course title (and course 物理化学基礎及び演習 [工化2] Instructor's name, job title, Graduate School of Engineering Professor,TANAKA TSUNEHIRO
	title in Physical Chemistry: Fundamentals and Exercises and department Graduate School of Engineering
	English) of affiliation Associate Professor, TERAMURA KENTARO
(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester
	Days and periods Tue.2 Class style Lecture Language distriction Japanese
	[Overview and purpose of the course]
[Courses delivered by instructors with practical work experience] (1) Category	In order to allow students to learn about the three fundamental laws of thermodynamics and apply them in physical chemistry, students are taught the fundamental matters and are given exercises (shorts tests) in the
A course with practical content delivered by instructors with practical work experience	latter half of each teaching session to check their level of understanding.
(2) Details of instructors' practical work experience related to the course	[Course objectives]
	The goal is to help students understand the fundamental laws of thermodynamics (especially the concept of entropy and the second law) and learn how to apply them to real physical chemistry systems.
(3) Details of practical classes delivered based on instructors' practical work experience	
	[Course schedule and contents] Physical chemistry systems (3 sessions), Tanaka
	 Systems and the surroundings, isolated systems, closed systems, open systems based on knowledge of the motion of material points/molecules, momentum and impulse, force and pressure, the kinetic theory of gas,
	gas state equations
	 Thermal equilibrium state of isolated systems, zeroth law of thermodynamics (transitivity of equilibrium), empirical temperature, state quantities and state variables (intensive properties and extensive properties),
	work, change of state (reversible, irreversible, quasi-static, minimal, cyclical) 3) State quantities and state variables (intensive properties and extensive properties), compressibility and
	coefficient of thermal expansion, infinitely small inrements and exact differentials
	Energetics (3 sessions), Tanaka
	4) Mechanical work driven by the motion of molecules and electrical work driven by the motion of electrons in an electric field, calorific value, internal energy, first law
	5) Enthalpy, Joule-Thomson experiment, heat capacity (constant volume, constant pressure), enthalpy of phase changes
	6) Heat of chemical reactions (Hess' law) (enthalpy of formation), heat of solution, atomic structure and
	chemical bonds, bond enthalpy
	Entropy and free energy (4 sessions), Tanaka & Teramura 7) Heat balance and entropy, reversible processes, Thomson's principle, Clausius inequality (Tanaka)
	8) Heat engine (cycle), Carnot cycle, thermodynamic temperature (absolute temperature) (Tanaka)
	9) Entropy associated with state changes, entropy of compounds (standard entropy), irreversible processes and entropy increases (Teramura)
	10) Helmholtz free energy, Gibbs free energy, thermodynamic potential, Maxwell relations (Teramura)
	Third law of thermodynamics (2 sessions), Teramura 11) Nernst' s heat theorem, the third law and entropy, residual entropy
	Continue to 物理化学基礎及び演習 [工(12] [2]↓↓↓
物理化学基礎及び演習[工化2](2)	物理化学基礎及び演習[工化2](3)
12) Adiabatic demagnetization method, approaching absolute zero	*Please visit KULASIS to find out about office hours.
Thermodynamics of open systems (2 sessions), Teramura 13) Partial molar quantity, chemical potential 14) Equilibrium of mixed systems, Gibbs-Duhem equation	
Feedback (1 session), Tanaka/Teramura	
15) The learning achieved in teaching sessions will be checked and applied to physics and physicochemical phenomena in various ways.	
[Course requirements]	
None	
[Evaluation methods and policy]	
Evaluation is based on either method A or method B below, dependent on which one produces better results.	

Method A: Regular examinations (100%)

Method B: Performance in teaching sessions (20%), mid-term test (30%), regular examinations (50%) Performance in teaching sessions refers to the students' participation in teaching sessions.

60 marks or above qualifies as a pass.
59 marks or below qualifies as a fail.

[Evaluation policy] Achievement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering.

[Textbooks]

Others; students must follow instructions given by the professor-in-charge

[References, etc.]

(Reference books) Others; Moore, W.J. (translated by Fujishiro, R.), Mooa butsuri kagaku (ue) dai 4-ban, (Tokyo Kagaku Dojin, 1974), parts of chapters 1, 2, 3 and 6, isbn {} {4807900021}; Atkins, P. (translated by Chihara, H., and Nakamura, N.), Atokinsu butsuri kagaku (ue) dai 8-ban, (Tokyo Kagaku Dojin, 2009), chapters 1-3 and parts of chapters 4 and 5, isbn {} {9784807906956}

[Study outside of class (preparation and review)]

udents must review exercises given during teaching sessions.

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

_____Continue to 物理化学基礎反び演習「工化2」(3)↓↓↓

se number U-ENG27 27102 LJ60	物理化学基礎及び演習 [工化3] (2)
title hymrse h	[Study outside of class (preparation and review)]
t year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester	(Other information (office hours, etc.))
d periods Tue.2 Class style Lecture Language distinction Japanese	*Please visit KULASIS to find out about office hours.
view and purpose of the course]	
	[Courses delivered by instructors with practical work experience] (1) Category
	A course with practical content delivered by instructors with practical work experience
se objectives]	(2) Details of instructors' practical work experience related to the course
	() Details of emotional classes delivered based on instruction? any stical media emotions
se schedule and contents]	(3) Details of practical classes delivered based on instructors' practical work experience
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se requirements]	
uation methods and policy]	
books]	
rences, etc.]	
ference books)	
Continue to 物理化学基礎及び演習〔工化3〕(2)↓↓↓	
	ı [
] [

Course n	umber	U-EN	G27 2	7102 LJ60							
Course title (and course title in English)	course 物理化学基礎及び演習 [工化4] n Physical Chemistry: Fundamentals and Exercises					nan and	tructor's ne, job ti I departn Iffiliation	nent	Graduate School of Engineering Associate Professor,UMEYAMA TOMOKAZU Graduate School of Engineering Associate Professor,SUGASE KENJ		
Farget yea	1 r 2nd	l year students	or above	Number	of cred	lits	2	Yea	r/semesters	2021/First semester	
Days and peri	ods Tue	.2	Class	s style	Lectur	e			Language of instruction	Japanese	
[Overview	and p	ourpose o	of the	course]							
Students are divided into four classes and each class is assigned a professor who conducts teaching sessions during the same time slot. The exercises given are sampled from questions appearing at the end of chapters in the reference book. However, the specific questions used and the way in which the exercises are given may differ from class to class. In order to allow students to learn about the three fundamental laws of thermodynamics and apply them in physical chemistry, students are also taught the fundamental matters and are given exercises to check their level of understanding.											
[Course o	bjectiv	ves]									
									ynamics (esp cal chemistry	ecially the concept of systems.	
[Course s	chedu	le and co	ntent	ts]							
knowledge of theory of ga thermodyna (intensive p	the ex of the n s and g mics (tr ropertie clical),	ternal worl notion of po as state equ ransitivity of s and exter	d (env oint m lations of equi nsive p	vironment), ass/molecu s, thermal e ilibrium), e properties),	les, moi quilibrii mpirica work, c	ment um s l ten hang	tum and state of i peratur ge of sta	impu solate e, stat te (rev	lse, force and d systems, ze e quantities a versible, irrev	pen systems based on pressure, the kinetic roth law of nd state variables ersible, quasi-static, ges and exact	
Energetics, 3 sessions Mechanical work driven by the motion of molecules and electrical work driven by the motion of electrons in an electrical field, calorific value, internal energy, first law, enthalpy, Joule-Thomson experiment, heat capacity (constant volume, constant pressure), enthalpy of phase changes, heat of chemical reactions (Hess' law) (enthalpy of formation), heat of solution, atomic structure and chemical bonds, bond enthalpy											
(cycle), Car changes, en	tions and tions and the tropy of the tropy o	nd entropy, le, thermod f compound	rever lynam ls (sta	ic temperat ndard entro	ure (abs py), irre	olut evers	e tempe sible pro	rature ocesse			
Third law o Nernst's h approaching	eat theo	orem, the th			opy, resi	dual	entropy	y, adia	batic demagn	etization method,	
								(Continue to 物理化	学基礎及び演習 [工化4] (2)↓↓	

_ _ _ _ _ _ _ _ _ _

Thermodynamics of open systems, 2 sessions Partial molar quantity, chemical potential, equilibrium of mixed systems, Gibbs-Duhem equation

Entirety of thermodynamics, 1 session The learning achieved in teaching sessions will be checked and applied to physics and physicochemical phenomena in various ways

[Course requirements]

lone

[Evaluation methods and policy]

Performance in teaching sessions (20%), regular examinations (80%) Student's performance in teaching sessions encompasses their participation in these sessions, marks on short tests taken during sessions, and marks from assigned reports. Obtaining at least 60 out of 100 marks is considered passing, while obtaining 59 or below out of 100 marks is considered a fail.

[Evaluation policy] Achievement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering.

[Textbooks]

Atkins, P., Paula, J. (translated by Nakano, M., Ueda, T., Okumura, M., and Kitagawa, Y.), Atkins butsuri kagaku (jou) dai 10-pan, (Tokyo Kagaku Dojin, 2017) ISBN: 978-4-8079-0909-4, chapters 1-3 and parts of chapters 4 and 5

[References, etc.] (Reference books)

(Nore, W.J. (translated by Fujishiro, R.), Moore butsuri kagaku (jou) dai 4-han, (Tokyo Kagaku Dojin, 1974) ISBN: 978-4-8079-0002-2, chapters 1, 2, 3, and parts of chapter 6

[Study outside of class (preparation and review)]

tudents must review exercises given during teaching sessions.

(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

_____Continue to 物理化学基礎及び演習 [工化4] (3)↓↓↓

物理化学基礎及び演習[工化4](3)	Course number U-ENG27 27103 LJ60
 2) Details of instructors' practical work experience related to the course 3) Details of practical classes delivered based on instructors' practical work experience 	- Course title (and course title in English) Exercises in Basic Organic Chemistry Instructor's Exercises in Basic Organic Chemistry Instructor's Exercises in Basic Organic Chemistry Instructor's and department of affiliation Instructor's and department of affiliation Instructor's and department
	Target year Ind year students or above Number of credits 2 Year/semesters 2021/First semes
	Days and periods Mon.1 Class style Lecture Language distriction Japanese
	[Overview and purpose of the course]
	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 chemi of carbonyl compounds, amines, and heterocycles.
	[Course schedule and contents]
	 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
	 Carboxylic acid derivatives (2) Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters acid halides.
	 Nucleophilic acyl substitution reactions (2) Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carbox acid derivatives.
	 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.
	 Amines and heterocycles (2) Study on the structure, properties, syntheses, and reactions of amines and heterocycles.
	8. Feedback (1) Continue to 右南化学来得及び溶習 [工化]

	未更新								
有機化学基礎及び演習[工化1](2)	Course number U-ENG27 27103 LJ60								
Course requirements] esirable to take Basic Organic Chemistry A and B.	Course title (and course title in English) Exercises in Basic Organic Chemistry								
Evaluation methods and policy]									
valuate based on a final written examination and exercises and tests during the lecture.	Target year Ind year students or above Number of credits 2 Year/semesters 2021/First semester								
[extbooks]	Days and periods Mon.1 Class style Lecture Language distution Japanese								
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	[Overview and purpose of the course]								
	This course systematically studies the basic concepts and principles of organic chemistry through lectures and								
References, etc.]	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								
(Reference books)	compounds are also studied.								
	[Course objectives]								
	Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemistry								
Study outside of class (preparation and review)]	of carbonyl compounds, amines, and heterocycles.								
reparation and reviewing the textbook are needed.	[Course schedule and contents]								
(Other information (office hours, etc.))	1. Aldehydes and ketones (2)								
Please visit KULASIS to find out about office hours.	Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.								
	 Nucleophilic addition reactions (3) Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones. Carboxylic acids and nitriles (1) Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles 								
	 Carboxylic acid derivatives (2) Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters and acid halides. 								
	 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.								
	 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(12] (2)↓↓								

機化学基礎及び演習 [工化2] (2)	未更新
機化子基礎及び演習 [工162] (2)	Course number U-ENG27 27103 LJ60
Course requirements] esirable to take Basic Organic Chemistry A and B.	Course title (and course) 有機化学基礎及び演習[工化3] Instructor's name, job title, title in Exercises in Basic Organic Chemistry and department Professor,HAMACHI ITARU
Evaluation methods and policy]	English)
valuate based on a final written examination and exercises and tests during the lecture.	Target year Und war students or above Number of credits 2 Year/semesters 2021/Einst samasta
Ŭ	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester
「extbooks] 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	Days and periods Mon.1 Class style Lecture Language distution Japanese
クマリー 『有機化子 主体反応への/ フローナ』(東京化子向人) ISBN:978480/900918	[Overview and purpose of the course]
	This course systematically studies the basic concepts and principles of organic chemistry through lectures
References, etc.]	exercises. Particular attentions are focused on the chemistry of carbonyl group, which is one of the most
(Reference books)	important functional group in organic chemistry. The organic chemistry of amines and heterocyclic compounds are also studied.
	compounds are also studied.
	[Course objectives]
Study outside of class (preparation and review)]	Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemist
eparation and reviewing the textbook are needed.	of carbonyl compounds, amines, and heterocycles.
paration and reviewing the textoook are needed.	[Course schedule and contents]
Other information (office hours, etc.))	1. Aldehydes and ketones (2)
Please visit KULASIS to find out about office hours.	Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.
	 Nucleophilic addition reactions (3) Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones. C. Lu, Li, Li, Li, Li, Li, Li, Li, Li, Li, Li
	 Carboxylic acids and nitriles (1) Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles
	 Carboxylic acid derivatives (2) Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters an acid halides.
	 Nucleophilic acyl substitution reactions (2) Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxyl 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.
	 Amines and heterocycles (2) Study on the structure, properties, syntheses, and reactions of amines and heterocycles.
	8. Feedback (1) Continue to 有關化学基礎及び演習 [工化3] [2)

	未更新
有機化学基礎及び演習[工化3](2)	Course number U-ENG27 27103 LJ60
Course requirements] Desirable to take Basic Organic Chemistry A and B.	Course title (and course) ftitle in Exercises in Basic Organic Chemistry English)
Evaluation methods and policy]	Assistant Professor, KATAHAKA EL
ivaluate based on a final written examination and exercises and tests during the lecture.	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester
Textbooks]	Days and periods Mon.1 Class style Lecture Language distinction Japanese
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	[Overview and purpose of the course]
	This course systematically studies the basic concepts and principles of organic chemistry through lectures
[References, etc.]	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
(Reference books)	compounds are also studied.
	[Course objectives]
[Study outside of class (preparation and review)]	Acquire the basic concept and knowledge, especially physical properties and reactions, of organic chemist of carbonyl compounds, amines, and heterocycles.
Preparation and reviewing the textbook are needed.	of carbonyl compounds, annines, and neterocycles.
	[Course schedule and contents]
(Other information (office hours, etc.))	1. Aldehydes and ketones (2)
*Please visit KULASIS to find out about office hours.	Study on the structures, properties, syntheses, and reactions of aldehydes and ketone.
[Courses delivered by instructors with practical work experience]	 Nucleophilic addition reactions (3) Study on the reactions and reaction mechanisms of the nucleophilic addition reactions to aldehydes and ketones.
 Category Course with practical content delivered by instructors with practical work experience 	3. Carboxylic acids and nitriles (1)
	Study on the structure, properties, syntheses, and reactions of carboxylic acids and nitriles
2) Details of instructors' practical work experience related to the course	4. Carboxylic acid derivatives (2)
(3) Details of practical classes delivered based on instructors' practical work experience	Study on the structure, properties, syntheses, and reactions of carboxylic acid derivatives, such as esters ar acid halides.
	 Nucleophilic acyl substitution reactions (2) Study on the reactions and reaction mechanisms of the nucleophilic acyl substitution reactions of carboxyl 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.
	 Amines and heterocycles (2) Study on the structure, properties, syntheses, and reactions of amines and heterocycles.
	8. Feedback (1) Continue to 有限化学基礎及び演習 [工化4] [2]

機化学基礎及び演習 [工化4] (2)	Course number U-ENG27 27104 LJ60
ourse requirements]	Course title (and course) 基礎無機化学 [T17, T18] Instructor's name, job title, Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ABE RYUU
irable to take Basic Organic Chemistry A and B.	title in Basic Inorganic Chemistry and department Associate Professor, TAKAI SHIGEO
valuation methods and policy]	English) of affiliation Institute for Liberal Arts and Scien Professor, TANAKA KATSUHIS.
luate based on a final written examination and exercises and tests during the lecture.	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester
extbooks]	
ウマリー 『有機化学 生体反応へのアプローチ』(東京化学同人)ISBN:9784807906918	Days and periods Fri.2 Class style Lecture Languaged instructor Japanese
	[Overview and purpose of the course] Students are taught the structure of atoms and molecules, and the chemical bonds and structures of inorgani
	solids, which are basics of inorganic chemistry needed in order to work as researchers and engineers in all
eferences, etc.] Reference books)	fields related to chemistry.
······	[Course objectives]
	To understand atomic structure, ionic bonds, covalent bonds, electronegativity, molecular structure, and bas crystal structures, which together form the foundations of inorganic chemistry.
udy outside of class (preparation and review)]	
paration and reviewing the textbook are needed.	[Course schedule and contents] Atomic structure (Chapter 1), 4 sessions
Other information (office hours, etc.))	After receiving an overview of the origin, abundance ratio, and classification of chemical elements, students
ease visit KULASIS to find out about office hours.	are given a general outline on the quantum mechanical method of expression for the orbitals of electrons in atom and atomic orbitals, and are taught the orbital approximation method and the building-up principle for
	dealing with many-electron atoms. Additionally, students are given an explanation on atomic parameters su
	as the atomic radius and ionic radius that characterize the properties of an atom, ionization energy, electron affinity, and electronegativity, and are taught how these atomic parameters are related to the periodicity of
	properties of chemical elements.
	Molecular structure and bonding (Chapter 2), 5 sessions
	Based on the idea of bonding electron pairs, students are taught about Lewis structures, formal charge,
	oxidation number, resonance, and the relationship between the molecular structure and the characteristics o bond (length and strength of a bond). Following this, the valence bond theory is explained, then concepts in
	the molecular orbital theory such as the bonding mode, expression of bond order, resonance, orbital overlap
	and hybrid orbitals are explained for diatomic molecules and polyatomic molecules.
	The structures of simple solids (Chapter 3), 5 sessions
	The structures of many inorganic crystals are well explained by models that atoms and ions are regarded as spheres and they are closely packed. Here, the concepts of the crystal lattice and the close-packed structure
	spheres that are needed for describing the structure of a crystal are explained. Following this, students are
	given an explanation about the structures of metal elements and alloys, and are taught about the characterisi structure of ionic solids, the effect of the cation to anion size ratio on the crystal structure, the concept of
	lattice enthalpy and the method of calculation using ionic models and thermodynamic data, and the various
	results derived from lattice enthalpy, among other matters concerning ionic solids in particular. Furthermor students are also taught about the relationship between the electronic structure and the electrical/electronic
	properties of solids.
	Continue to 基礎無機化字 [T17, T18] (2)↓
	Continue To 基礎無機化学〔1717, 718〕(2)↓
礎無機化学 [T17, T18] (2)	Continue to 基礎無機化学 [1717, 718] (2)↓
	Course number U-ENG27 27104 LJ60 Course title Instructor's Graduate School of Engineering Professor,MIURA KIYOTAKA
礎無機化学 [T17, T18] (2) nfirmation of learning achieved, 1 session re, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course Instructor's 基礎無機化学 [T19, T20] Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering
nfirmation of learning achieved, 1 session re, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MATSUI TOSHIL Institute for Liberal Arts and Scien
nfirmation of learning achieved, 1 session re, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's associate Professor,MIURA KIYOTAKA Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MATSUI TOSHIJ Institute for Liberal Arts and Scien Professor,TANAKA KATSUHIS
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed. Durse requirements] lents must have introductory knowledge on physics and chemistry.	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's associate Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MIURA KIYOTAKA Graduate School of Engineering Institute for Liberal Arts and Scien Professor,TANAKA KATSUHIS
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed. Durse requirements] lents must have introductory knowledge on physics and chemistry. raluation methods and policy]	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's associate Professor,MIURA KIYOTAKA Graduate School of Engineering Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MATSUI TOSHIJ Institute for Liberal Arts and Scien Professor,TANAKA KATSUHIS
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's 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,MIURA KIYOTAKA Graduate School of Engineering Professor,TANAKA KATSUHIS Target year Ind year students or above Days and periods Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Impage distactor Japanese [Overview and purpose of the course] U Vertified of the course U Vertified of the course
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 L160 Course title (and course title in English) Instructor's 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 TOSHI, Institute for Liberal Arts and Scien Professor,TANAKA KATSUHIS Target year Ind year students or abov Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Language/instructor Japanese [Overview and purpose of the course] Students are taught the structure of atoms and molecules, and the chemical bonds and structures of inorganic
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course) 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 Associate Professor,MURA KIYOTAKA Associate Professor,MURA KIYOTAKA Associate Professor,MATSUI TOSHI/ Institute for Liberal Arts and Scien Professor,TANAKA KATSUHIS. Target year Pad year students or abov Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Lapage distudity Japanese
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed. Durse requirements] dents must have introductory knowledge on physics and chemistry. valuation methods and policy] luation is based on results from regular examinations. aluation policy] nevement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering. extbooks] ller, M., et al. (translated by Tanaka, K., Takahashi, M., Abe, T., Hirao, K., Kitagawa, S.) [[Shuraibaa]	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's Basic Inorganic Chemistry Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, MURA KIYOTAKA Graduate School of Engineering Associate Professor, MATSUI TOSHI, Institute for Liberal Arts and Scien Professor, TANAKA KATSUHIS Target year Ind year students or abov Number of credits 2 Year/Semesters 2021/First semester Days and periods Fri.2 Class style Lecture Language distinctor Japanese [Overview and purpose of the course] Students are taught the structure of atoms and molecules, and the chemical bonds and structures of inorgani solids, which are basics of inorganic chemistry needed in order to work as researchers and engineers in all fields related to chemistry.
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed. Durse requirements] lents must have introductory knowledge on physics and chemistry. Auluation methods and policy] luation is based on results from regular examinations. aluation policy] uevement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering. Extbooks] ler, M., et al. (translated by Tanaka, K., Takahashi, M., Abe, T., Hirao, K., Kitagawa, S.) [Shuraibaa	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's Basic Inorganic Chemistry Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor,MIURA KIYOTAKA Graduate School of Engineering Associate Professor,MATSUI TOSHI. Institute for Liberal Arts and Scier Professor,TANAKA KATSUHIS Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Impute distuder Japanese IOverview and purpose of the course] Students are taught the structure of inorganic chemistry needed in order to work as researchers and engineers in all fields related to chemistry. ICourse objectives]
firmation of learning achieved, 1 session e, the students' understanding of the lecture contents is confirmed.	Course number U-ENG27 27104 LJ60 Course title (and course title in English) Instructor's Basic Inorganic Chemistry Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, MIURA KIYOTAKA Graduate School of Engineering Associate Professor, MATSUI TOSHL Institute for Liberal Arts and Scier Professor, TANAKA KATSUHIS Target year 2nd year students or abov Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Impute distuder Japanese IOverview and purpose of the course] Students are taught the structure of atoms and molecules, and the chemical bonds and structures of inorgani solids, which are basics of inorganic chemistry needed in order to work as researchers and engineers in all fields related to chemistry. ICourse objectives]
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基礎無機化学[T19, T20](2)	Course number U-ENG27 27104 LJ60
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atokinsu muki kagaku dai 6-ban (jyoukan)』(Tokyo Kagaku Dojin, 2016)ISBN:9784807908981	[Course objectives] To understand atomic structure, ionic bonds, covalent bonds, electronegativity, molecular structure, and ba
	crystal structures, which together form the foundations of inorganic chemistry.
[References, etc.] (Reference books)	[Course schedule and contents]
[Study outside of class (preparation and review)] Before attending a lecture, students must prepare by reading the textbook; after attending a lecture, students	After receiving an overview of the origin, abundance ratio, and classification of chemical elements, studen are given a general outline on the quantum mechanical method of expression for the orbitals of electrons in atom and atomic orbitals, and are taught the orbital approximation method and the building-up principle for dealing with many-electron atoms. Additionally, students are given an explanation on atomic parameters so as the atomic radius and ionic radius that characterize the properties of an atom, ionization energy, electron affinity, and electronegativity, and are taught how these atomic parameters are related to the periodicity of
(Other information (office hours, etc.))	properties of chemical elements.
*Please visit KULASIS to find out about office hours.	Molecular structure and bonding (Chapter 2), 5 sessions Based on the idea of bonding electron pairs, students are taught about Lewis structures, formal charge, oxidation number, resonance, and the relationship between the molecular structure and the characteristics. bond (length and strength of a bond). Following this, the valence bond theory is explained, then concepts if the molecular orbital theory such as the bonding mode, expression of bond order, resonance, orbital overla and hybrid orbitals are explained for diatomic molecules and polyatomic molecules. The structures of simple solids (Chapter 3), 5 sessions The structures of many inorganic crystals are well explained by models that atoms and ions are regarded a spheres and they are closely packed. Here, the concepts of the crystal lattice and the close-packed structure spheres and they are closely packed. Here, the concepts of the crystal lattice and the close-packed structure spheres in explanation about the structures of metal elements and alloys, and are taught about the character i structure of ionic solids, the effect of the cation to anion size ratio on the crystal structure, the concept of lattice enthalpy and the method of calculation using ionic models and thermodynamic data, and the variou results derived from lattice enthalpy, among other matters concerning ionic solids in particular. Furthermo students are also taught about the relationship between the electronic structure and the electrical/electronic properties of solids.
	未更新

基礎無機化学[T21, T22](2)	Course number U-ENG27 27105 LJ60 U-ENG27 27105 LJ76
Confirmation of learning achieved, 1 session Here, the students' understanding of the lecture contents is confirmed. [Course requirements]	Course title (and course title in English) Course title (and course title in English) Course title (and course title in English) Course title (and course Fundamental Chemical Process Engineering の子は たデレーセス工学基礎 [T17, T18] and department of affiliation Craduate School of Engine Professor,MAE KAZUHII (and department of affiliation
Students must have introductory knowledge on physics and chemistry.	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First se
[Evaluation methods and policy]	
Evaluation is based on results from regular examinations.	Days and periods Thu.2 Class style Lecture Language distriction Japanese [Overview and purpose of the course]
[Evaluation policy] Achievement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering.	[Overview and purpose of the course]
[Textbooks]	
Weller, M., et al. (translated by Tanaka, K., Takahashi, M., Abe, T., Hirao, K., Kitagawa, S.) 『Shuraibaa atokinsu muki kagaku dai 6-ban (jyoukan)』 (Tokyo Kagaku Dojin, 2016)ISBN:9784807908981	[Course objectives]
[References, etc.]	[Course schedule and contents]
(Reference books)	,2times, ,2times, ,2times, ,1time,
[Study outside of class (preparation and review)] Before attending a lecture, students must prepare by reading the textbook; after attending a lecture, students	,0.5times, ,1time,
will review the material by solving exercises in the textbook.	,1.5times, ,1time,
(Other information (office hours, etc.))	,2times, .1time,
*Please visit KULASIS to find out about office hours.	, tune, , 1time,
	[Course requirements]
	None
	[Evaluation methods and policy]
	[Textbooks]
	[References, etc.]
	(Reference books)
	Continue to 化学プロセズ工学基础 [117,

学プロセス工学基礎 [T17, T18] (2)	Course number U-ENG27 27105 LJ60 U-ENG27 27105 LJ76
Study outside of class (preparation and review)]	- Course title (and course title (and course title in English) Course title (and course title in English) Course title (and course Fundamental Chemical Process Engineering Fundamental Chemical Process Fundamental Chemical Process Fundamental Chemical Process Fundamental Chemical Process Fundamental Chemical Process Fundamental Chemical Process Fundamental Chemical Process Fundamental Process Fundamental Proces
Other information (office hours, etc.))	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/First semest
lease visit KULASIS to find out about office hours.	Days and periods Thu.2 Class style Lecture Lappaper distriction Japanese [Overview and purpose of the course]
Courses delivered by instructors with practical work experience]) Category course with practical content delivered by instructors with practical work experience) Details of instructors' practical work experience related to the course	Transport phenomenon of materials, energy, and momentum are important not only in chemical processes 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, ene 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.
) Details of practical classes delivered based on instructors' practical work experience	[Course objectives] To learn fundamentals of chemical process engineering particularly transport phenomena and chemical reaction engineering.
	 Weeks 1 and 2: Fluid dynamics (momentum transport) Basic concepts of transport phenomena, momer transport in fluids as well as Newton's law of viscosity, laminar flow of Newtonian fluid, turbulent flow a 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 la heat transfer at fluidsolid interface and heat transfer coefficient, convective heat transfer, and principles 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 diffus 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

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化学プロセス工学基礎 [T19, T20] (2)

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 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] lone

[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)
- (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). part (transport piteinonicita) and the and pite (transport pite) and pite) and pite (transport pite) an

化学プロセス工学基礎 [T19, T20] (3)

*Please visit KULASIS to find out about office hours.

未更新	
Course number U-ENG27 27105 LJ60 U-ENG27 27105 LJ76	化学プロセス工学基礎 [T21, T22] (2)
Course title (and course Hundamental Chemical Process Engineering English) Instructor's Instructor's Fundamental Chemical Process Engineering and department of affiliation Graduate School of Engineering Professor,MIYAHARA MINORU Graduate School of Engineering Associate Professor,NAKAGAWA HIROVUKI Graduate School of Engineering Professor,VAMAMOTO RYOICHI Target year End year students or above Number of credits 2 Year/semesters 2021/First semester	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.
Days and periods Thu. 1 Class style Lecture Language distuding Japanese	[Course requirements]
[Overview and purpose of the course]	None
Transport phenomenon of materials, energy, and momentum are important not only in chemical processes	[Evaluation methods and policy]
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, fundamentalis of chemical reaction engineering which	Absolute evaluation of intermediate and final examinations. Take-home assignments and in-class quizzes are imposed and evaluated if necessary.
aims to analyze and design chemical reactors are lectured. Categorization of reactor operation and shapes of	[Textbooks]
reactors is explained from engineering viewpoint and methods for formulating reaction rate equations from experimental data and for designing reactors are then explained.	K. Hashimoto and F. Ogino ed. 『Gendai Kagakukogaku (2001)』 (Sangyo Tosho) ISBN:4782826095
[Course objectives]	
To learn fundamentals of chemical process engineering particularly transport phenomena and chemical reaction engineering.	[References, etc.] (Reference books) F. Ogino Tido Gensho.] (Sangyo Tosho) ISBN:478282520X
[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.	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)]
Weeks 3 and 4: Heat transfer (energy transport) Types of heat transfer, heat conduction and Fourier's law, heat transfer at fluidsolid interface and heat transfer coefficient, convective heat transfer, and principles of	Read through a corresponding part of the textbooks before the lecture. Assignments are usually taken from
heat exchanger are lectured. Weeks 5 and 6: Diffusion (material transport) Diffusion and Fick's laws, analogy between momentum	the textbooks.
transport, energy transport, and material transport, equimolar counter diffusion and one-directional diffusion, and application to diffusion problems are lectured.	(Other information (office hours, etc.))
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.	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).
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.	*Please visit KULASIS to find out about office hours.
Weeks 9 and 10: Reaction rate equation Definition of reactions and reactors non-eighteening viewpoint is explained.	[Courses delivered by instructors with practical work experience]
explained. Steady-state approximation and partial equilibrium approximation fro formulation of overall reaction are lectured.	(1) Category A course with practical content delivered by instructors with practical work experience
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.	(2) Details of instructors' practical work experience related to the course
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 化学プロセズ工学基礎 [121, 122] (2) ↓↓↓	(3) Details of practical classes delivered based on instructors' practical work experience

Course num	ber	U-ENC	327 27	7111 LJ60)				未更新
Course title (and course title in English)				^左) rontier Ch	emistry)	Instructor's name, job ti and departn of affiliation	nent		hool of Engineering AKAO YOSHIAKI
Farget year	2nd yea	r students o	or above	Number	of cred	lits 2	Year	/semesters	2021/Second semester
Days and periods	Mon.1		Class	style	Lecture	e		Language of instruction	Japanese
[Course obj	ectives	5]							
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3times, 2times, 2times, 1time, [Course req	uireme	nts]							
	uireme	ents]							
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3 times, 2 times, 2 times, 1 time, [Course req None		-	polic	y]			_		
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3times, 2times, 2times, 1time, [Course req None [Evaluation		-	polic	y]					
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3times, 2times, 2times, 1time, [Course req None [Evaluation	metho	ds and	polic	y]					
3times, 2times, 2times, 1time, [Course req None [Evaluation [Textbooks] [References	metho	ds and	polid	y]					
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										未更新	
Course nu	umber	U-EN	327 2	7112 LJ60							
Course title (and course title in English)				rontier Chemistry) and department of affiliation				nent	Graduate School of Engineering Professor,KOGA TSUYOSHI Graduate School of Engineering Associate Professor,NISHIDA KOUJ Graduate School of Engineering Assistant Professor,KOJIMA HIROYUK		
arget yea	r 21	ad year students or above Number of credits 2 Year/semesters				2021/Second semester					
Days and perio	ods W	ed.2	Clas	s style	Lecture	e			Language of instruction	Japanese	
Overview	and	purpose o	f the	course]							
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•	ched	ule and co	nten	ts]							
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None	squiri	ementaj									
		41									
[Evaluatio	on me	thods and	polle	cy]							
[Textbook	'el										
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图化学Ⅰ(創成化学)(2)	Course number U-ENG27 27113 LJ60
	Course title Instructor's Graduate School of Engineer
udy outside of class (preparation and review)]	(and course 無機化学(創成化学) Inorganic Chemistry (Frontier Chemistry) English)
ther information (office hours, etc.))	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second s
ase visit KULASIS to find out about office hours.	Days and periods Mon.2 Class style Lecture Language distruction Japanese
	[Overview and purpose of the course]
urses delivered by instructors with practical work experience] Category	
urse with practical content delivered by instructors with practical work experience	[Course objectives]
Details of instructors' practical work experience related to the course	
Details of practical classes delivered based on instructors' practical work experience	[Course schedule and contents]
	3times, 3times,
	,4times, 4times,
	, 1 times,
	[Course requirements]
	None
	[Evaluation methods and policy]
	[Textbooks]
	[References, etc.]
	(Reference books)
	Course number U-ENG27 27114 LI60 Graduate School of Engineer Course title Instructor's Graduate School of Engineer
	Course title (and course title in English) Course title (and course title) Course title (and course title) Course title (and course title) Course title (and course) Course title (
udy outside of class (preparation and review)] ther information (office hours, etc.))	Course title (and course title in Analytical Chemistry (Frontier Chemistry) and department
udy outside of class (preparation and review)] ther information (office hours, etc.))	Course title (and course title in English) Analytical Chemistry (Frontier Chemistry) Instructor's name, job title, Analytical Chemistry (Frontier Chemistry) of affiliation Graduate School of Engineer of affiliation and department of affiliation Science Professor, KUBO T.
Idy outside of class (preparation and review)] ther information (office hours, etc.)) ase visit KULASIS to find out about office hours.	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 Engineen Associate Professor, OYAMA MU Graduate School of Engineen Associate Professor, KUBO T. Days and periods Fri.2 Class style Lecture Imput af instructor Imput af instructor Imput af instructor [Overview and purpose of the course] Imput af instructor Japanese
udy outside of class (preparation and review)] ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. urses delivered by instructors with practical work experience] Category	Course title (and course title in English) 分析化学(創成化学) Analytical Chemistry (Frontier Chemistry) Instructors name, job title, and qopartment of affiliation Graduate School of Engineen Professor,OYSUKA KOJI Graduate School of Engineen Associate Professor,OYAMA MU Graduate School of Engineen Professor,OYAMA MU Graduate School o
ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. urses delivered by instructors with practical work experience] Category urse with practical content delivered by instructors with practical work experience	Course title (and course title in English) 分析化学(創成化学) Analytical Chemistry (Frontier Chemistry) and department of affiliation Instructor's name, job title, and department of affiliation Graduate School of Engineen Associate Professor, OYAMA MU Graduate School of Engineen Associate Professor, CUSA Japanese IOverview and purpose of the courseJ As an introduction to analytical chemistry, basic subjects related to the underlying chemical equilibriu solution, including acid-base, complex formation, redox, dissolution, and partition equilibrium, will be and some exercises will also be conducted.
ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. urses delivered by instructors with practical work experience] Category urse with practical content delivered by instructors with practical work experience	Course title (and course title in English) 分析化学(創成化学) Analytical Chemistry (Frontier Chemistry) Instructors name, job title, and qopartment of affiliation Graduate School of Engineen Professor,OYSUKA KOJI Graduate School of Engineen Associate Professor,OYAMA MU Graduate School of Engineen Professor,OYAMA MU Graduate School o
ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. urses delivered by instructors with practical work experience] Category urse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course	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 Engineen Professor,OTSUKA KOJI Graduate School of Engineen Associate Professor,OYAMA MU Graduate School of Engineen Associate Professor,OYAMA MU Graduate School of Engineen Professor,OYAMA MU Graduate School of Engineen Associate Professor,OYAMA MU Associate Professociate Associnter Associate Professor,OYAMA MU Associate Profe
udy outside of class (preparation and review)] ther information (office hours, etc.)) ease visit KULASIS to find out about office hours. burses delivered by instructors with practical work experience] Category ourse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course	Course title (and course title in English) 分析代ピ学(創成化学) Analytical Chemistry (Frontier Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineen Associate Professor, OYAMA MU Graduate School of Engineen Associate Professor, CUBON Japanese Iour View and purpose of the course] As an introduction to analytical chemistry, basic subjects related to the underlying chemical equilibriu solution, including acid-base, complex formation, redox, dissolution, and partition equilibrium, will be and some exercises will also be conducted. ICourse objectives] Learn important matters related to in-solution chemical equilibrium, which is the basis of analytical chemical equilibrium and the basis of analytical chemical equi
批学 (創成化学) (2) udy outside of class (preparation and review)] ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. purses delivered by instructors with practical work experience] Category ourse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course Details of practical classes delivered based on instructors' practical work experience	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 Engineen Professor, OYAMA MU Graduate School of Engineen Associate Professor, OYAMA Japanese [Overview and purpose of the course] As an introduction to analytical chemistry, basic subjects related to the underlying chemical equilibrium and some exercises will also be conducted. [Course objectives] Learn important matters related to in-solution chemical equilibrium, which is the basis of analytical che I. Outline of chemical equilibrium (2): Explain the basics of chemical equilibrium as the basis for deal with in-solution chemical equilibrium, such as acid-base, complex formation, precipitation, and redox
udy outside of class (preparation and review)] ther information (office hours, etc.)) case visit KULASIS to find out about office hours. purses delivered by instructors with practical work experience] Category ourse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course	Course title (and course title in English) 分析化之学(創成化之学) Analytical Chemistry (Frontier Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineen Professor,OYSUKA KOJI Graduate School of Engineen Associate Professor,OYAMA MU Graduate School of Engineen Associate Professor,OYAMA MU Associate Professor,O
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udy outside of class (preparation and review)] ther information (office hours, etc.)) case visit KULASIS to find out about office hours. purses delivered by instructors with practical work experience] Category ourse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course	Course title (and course title in English) 分析化学(創成化合学) Analytical Chemistry (Frontier Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineen Associate Professor, VUMA KUU Graduate School of Engineen Associate Professor, KUBO T. Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second s Days and periods Fri.2 Class style Lecture Lequity Japanese [Overview and purpose of the course] As an introduction to analytical chemistry, basis subjects related to the underlying chemical equilibrium solution, including acid-base, complex formation, redox, dissolution, and partition equilibrium, will be and some exercises will also be conducted. [Course objectives] Learn important matters related to in-solution chemical equilibrium, which is the basis of analytical chemical equilibrium (2): Explain the basics of chemical equilibrium as the basis for deal with in-solution chemical equilibrium (2): Explain the basics of chemical equilibrium and redox reactions. 2. Acid-base equilibrium (4): Based on the Bronsted's definition of acids and bases, the pH calculation methods for various solutions are explained. The acid-base equilibrium in complex systems contain polyportic acids will also be shown. 3. Complex formation equilibrium (4): Mainly for chelatometric titration, the condition formation come evaluated in consideration of side reactions, such as the protonation of ligands and the complexing effi- mental ions. And discussed. 4. Redox equilibrium (4):
ther information (office hours, etc.)) ase visit KULASIS to find out about office hours. urses delivered by instructors with practical work experience] Category urse with practical content delivered by instructors with practical work experience Details of instructors' practical work experience related to the course	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 Engineen School of Engineen Associate Professor, OYAMA, MU Graduate School of Engineen Associate Professor, KUBO T. Target year 2nd year students or above August and purpose of the course] 2 Year/semesters 2021/Second s Days and periods Fri.2 Class style Lecture Lapped limits Japanese [Overview and purpose of the course] As an introduction to analytical chemistry, basic subjects related to the underlying chemical equilibrium solution, including acid-base, complex formation, redox, dissolution, and partition equilibrium, will be and some exercises will also be conducted. [Course objectives] Learn important matters related to in-solution chemical equilibrium, which is the basis of analytical che with in-solution chemical equilibrium (2): Explain the basics of chemical equilibrium as the basis for deal with in-solution chemical equilibrium (2): Explain the basics of chemical equilibrium as the basis for deal with in-solution solutions are shown, and the estimation of the neutralization titration curve, select indicators, and buffer solutions are explained. The acid-base equilibrium in complex systems containin polyprotic acids will also be shown. 3. Complex formation equilibrium (4): Mainly for chelatometric titration, the condition formation come evaluated in consideration of side reactions, such as the protonation of ligands and the complexing effi metal ions. And discuss the feasibility of complex titratio

析化学(創成化学)(2)	Course number U-ENG27 27115 LJ61 U-ENG27 27115 LJ62
	Course title Instructor's Graduate School of Engineering
Evaluation methods and policy]	Course title (and course) 高分子化学基礎 I (創成化学) Instructor's Graduate School of Engineering Associate Professor,NISHIDA KC
valuation will be based on assignments (80%) and class performance (20%).	title in English) Elements of Polymer Chemistry I (Frontier Chemistry) and department of affiliation article action of Englineering Associate Fochsool of Englineering Associate Polymer Chemistry I (Frontier Chemistry)
Fextbooks] aniel C. Harris 『Quantitative Chemical Analysis, 10th Ed.』 (W. H. Freeman, 2020) ISBN:	
niel C. Harris 『Quantitative Chemical Analysis, 10th Ed.』 (W. H. Freeman, 2020) ISBN: 81319324506	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second seme
	Days and periods Thu.2 Class style Lecture Language distructor Japanese
References, etc.]	[Overview and purpose of the course]
(Reference books)	
troduced during class	
	[Course objectives]
tudy outside of class (preparation and review)]	1
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	[Course schedule and contents]
Other information (office hours, etc.))	,2times,
ease visit KULASIS to find out about office hours.	,ltime,
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	[Course requirements]
	None
	[Evaluation methods and policy]
	[Textbooks]
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高分子化学基礎 I (創成化学)(2)	Course numbe
References, etc.]	Course title
(Reference books)	(and course 有機 title in English)
[Study outside of class (preparation and review)]	Target year
	Days and periods W
(Other information (office hours, etc.))	[Overview and
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	(Reference b
	[Study outside
	(Other inform
	*Please visit KUI

										未更新	
Course nu	umber	U-EN	G27 3	7117 LJ60							
Course title (and course title in English)	e 有機化学II(創成化学) Organic Chemistry II (Frontier Chemistry)					nar anc	tructor's ne, job ti d departn affiliation	nent	Graduate School of Engineering Professor,MATSUBARA SEIJIROU		
arget yea	r Br	d year students o	or above	Number	of cred	lits	2	Year	/semesters	2021/First semester	
Days and perio	ods We	ed.2	Clas	s style	Lectur	e			Language of instruction	Japanese	
Overview	and	purpose o	f the	course]							
[Course o	bjecti	ives]				_					
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[Course s	chedu	ule and co	nten	ts]							
3times,											
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ltime,											
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[Course re	equire	ements									
vone											
[Evaluatio	Evaluation methods and policy]										
[Textbook	s]										
[Referenc		-									
(Refere	nce b	ooks)									
[Study ou	tside	of class (p	orepa	ration and	d revie	w)]					
		ation (offic									
Please visit	t KUL	ASIS to find	louta	about office	hours.	-					

未更新	
Course number U-ENG27 37118 LJ61	生体関連物質化学(創成化学)(2)
	╡ └
Course title (and course) E本体関連物質化学(創成化学) Instructor's name, job title, Graduate School of Engineering Professor,NUMATA KEIJI	[Study outside of class (preparation and review)]
title in Biorelated Material Chemistry and department Graduate School of Engineering	
English) of affiliation Senior Lecturer,OOMAE MASAS	
Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester	(Other information (office hours, etc.))
	*Please visit KULASIS to find out about office hours.
Days and periods Tue.1 Class style Lecture Language distinction Japanese	
[Overview and purpose of the course]	[Courses delivered by instructors with practical work experience]
	(1) Category
	A course with practical content delivered by instructors with practical work experience
[Course objectives]	(2) Details of instructors' practical work experience related to the course
In the second seco	(3) Details of practical classes delivered based on instructors' practical work experience
[Course schedule and contents] .4 times,	
,4times,	
,4times,	
,3times,	
[Course requirements]	
None	
[Evaluation methods and policy]	
[Textbooks]	
a concerna	
[References, etc.]	
(Reference books)	
Continue to 生体関連物質化学(創成化学)(2)↓	

		LI ENCOZ	27110 L ICO					未更新
Course num	ber	U-ENG27	57119 LJ60					
	d course 物理化学Ⅲ(創成化学) hysical Chemistry Ⅲ (Frontier Chemistry) and department II (Frontier Chemistry)					ofessor,OONO KOUJ Chemical Research		
arget year	3rd y	ear students or abov	Number	of cred	lits 2	Yea	r/semesters	2021/First semester
Days and periods	Wed.	1 Clas	s style	Lecture	e		Language of instruction	Japanese
Overview a	nd pu	irpose of the	course]					-
Course obje	ective	es]						
Course sch	edule	and conter	tsl					
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a. 1								
2times,								
2times, 2times, 4times,								
2times, 4times, 3times,								
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2times, 4times, 3times, 1time,	uirem	nents]						
2times, 4times, 3times, 1time, [Course requ	uiren	ients]						
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2times, 4times, 3times, 1time, [Course requisition] None			cy]					
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2times, 4times, 3times, 1time, [Course requ None [Evaluation r			cy]					
2times, 4times, 3times, 1time, [Course requ None [Evaluation n [Textbooks]	meth	ods and poli	cy]					
2times, 4times, 3times, 1time, [Course requ None [Evaluation r	neth	ods and poli	cy]					
2times, 4times, 3times, 1time, [Course requised None [Evaluation in [Textbooks] [References	neth	ods and poli	cy]					
2times, 4times, 3times, 1time, [Course requised None [Evaluation [Textbooks] [References (References	neth , etc.	ods and poli		d revie	w)1			
2times, 4times, 3times, 1time, [Course requised None [Evaluation in [Textbooks] [References	neth , etc.	ods and poli		d revie	w)]			
2times, 4times, 3times, 1time, None [Evaluation f [Textbooks] [References (References [Study outsi	, etc. ∋ boc	ods and poli	aration an		w)]			

										未更新
Course nu	umber	r U-EN	327 3	7120 LJ61	U-EN	G27	37120	LJ62		
Course title (and course title in English)		子化学基礎 nts of Polymer C			Themistry)	nan and	tructor's ne, job tit I departm ffiliation	nent	Associate Profes Graduate Sch	nool of Engineering sor,HORINAKA JIYUNICHI nool of Engineering ssor,TERASHIMA TAKAYA
arget yea	r 31	rd year students o	or above	Number	of cred	lits	2	Yea	/semesters	2021/First semester
Days and perio				s style	Lecture	e			Language of instruction	Japanese
[Overview	and	purpose o	f the	course]						
-										
[Course o	bject	tives]								
-	ched	ule and co	ntent	s]						
2times,										
2times,										
3times,										
3times, 4times.										
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, rume,										
[Course re	equir	ements]								
None										
[Evaluatio	n me	thods and	polic	y]						
-										
[Textbook	s]									
[Referenc	es, el	tc.]								
(Referen	nce b	ooks)								
[Study ou	tside	of class (p	orepa	ration an	d revie	w)]				
(Other in	forma	ation (offic	e hou	ırs, etc.))			_			
*Please visit	t KUL	ASIS to find	l out a	bout office	e hours.					

未更新 Course number U-ENG27 37121 LJ61	Course number U-ENG27 37122 LJ60
Course title Instructor's	Course title Instructor's Graduate School of Engineering Professor,OTSUKA KOJI
(and course (and course) title in English) にのduction to Statistical Thermodynamics (Frontier Chemistry) English) にのduction to Statistical Thermodynamics (Frontier Chemistry) のする新聞語のの はのないのでのまた。 な引きたいののでのでのでのでのでのでのでのでのでのでのでのでのでのでのでのでのでのでの	(and course) 機器分析化学(創成化学) title in English) にないのものは、のでは、のでは、のでは、のでは、のでは、のでは、のでは、のでは、のでは、の
Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester	Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester
Days and periods Mon.2 Class style Lecture Language distution Japanese	Days and periods Fri.1 Class style Lecture Language d'instruction Japanese
[Overview and purpose of the course]	[Overview and purpose of the course]
	As an introduction to instrumental analysis, chromatography, spectral analysis and electrochemical analysis are shown.
[Course objectives]	[Course objectives]
	Learn the principles and applications of typical instrumental analysis methods. [Course schedule and contents]
[Course schedule and contents] 2times, 3times, 3times,	 Chromatography (4): The basic theory and principle of chromatography, including the plate and kinetic theory and parameters related to retention and separation, are explained. Then equipment and separation characteristics of both gas chromatography and high performance liquid chromatography will be introduced.
,3times, ,3times,	 Spectral analysis (5): After explaining the properties of electromagnetic waves and their interaction with substances, derivation of the Beer's law, which is important in light absorption measurement, as well as its
,1time,	use in quantitative analysis are shown. In addition, the principles, equipment, and measurement methods of ultraviolet-visible absorption spectrophotometry, and fluorescence/phosphorescence spectrophotometry are
[Course requirements] None	discussed.
[Evaluation methods and policy]	3. Electrochemical analysis (5): Regarding the potentiometric method (potentiometric), the details of the electrodes that are the basis of the measurement and the measurement principle are explained. The response principle of ion-selective electrodes and pH measurement using glass electrodes will also be explained. In addition, electrolytic gravimetric analysis and coulometry will be introduced.
[Textbooks]	4. Confirmation of learning achievement (1): Confirm (comment) the achievement of the contents of this
	lecture. [Course requirements]
[References, etc.]	Completed or learned "Analytical Chemistry (Frontier Chemistry)" is recommended.
(Reference books)	[Evaluation methods and policy] Evaluation will be based on assignments (80%) and class performance (20%).
[Study outside of class (preparation and review)]	[Textbooks] Daniel C. Harris 『Quantitative Chemical Analysis, 10th Ed.』 (W. H. Freeman, 2020) ISBN:
(Other information (office hours, etc.))	9781319324506
*Please visit KULASIS to find out about office hours.	Continue to 機器分析化学(創成化学)(2)↓↓↓
機器分析化学(創成化学)(2)	Course number U-ENG27 37123 LJ60
[References, etc.]	Course title (and course title in English) 有機化学III(創成化学) Instructor's name, job title, organic Chemistry III (Frontier Chemistry) Graduate School of Engineering and department of affiliation Sociate Professor, KURAHASHI TAKUYA Graduate School of Engineering Associate Professor, YOSHIHIRO SASAKI
(Reference books) Introduced during class	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester
	Days and periods Tue.2 Class style Lecture Language distuding Japanese
[Study outside of class (preparation and review)] Introduced during class if necessary.	[Overview and purpose of the course]
(Other information (office hours, etc.))	
*Please visit KULASIS to find out about office hours.	[Course objectives]
	[Course schedule and contents] ,2times,
	,2times, ,2times, ,2times, ,2times, ,2times,
	,2times, ,2times, ,2times, ,2times, ,2times, ,2times,
	,2times, ,2times, ,2times, ,2times, ,2times,
	,2times, ,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements]
	,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements] None
	,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements] None
	,2times, ,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements] None [Evaluation methods and policy]
	,2times, ,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements] None [Evaluation methods and policy]
	,2times, ,2times, ,2times, ,2times, ,2times, ,2times, ,4times, [Course requirements] None [Evaluation methods and policy] [Textbooks] [References, etc.]
	2times, 2times, <td< th=""></td<>
	2times, 2times, 2times, 2times, 2times, 2times, 2times, 2times, [Course requirements] None [Evaluation methods and policy] [Textbooks] [References, etc.] (Reference books)

Course number U-ENG27 37124 LJ60	物理化学Ⅲ(創成化学)(2)
Sourse title and course title in inglish) 物理化学III(創成化学) Physical Chemistry III (Frontier Chemistry) Instructor's name, job title, and department of affiliation	Magnetic resonance (7) Intermolecular interactions (1 class) Electrical properties Intermolecular interactions
arget year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester	
ys and periods Tue.1 Class style Lecture Languaged instruction Japanese	Final examination/ Confirmation of extent of student learning
Diverview and purpose of the course]	Feedback (1 class)
Physical Chemistry III (frontier chemistry), lectures will focus on quantum chemstry, which is one of the	[Course requirements]
ore subjects in physical chemistry as well as thermodynamics and statistical thermodynamics: quantum hemistry describe the dynamics and properies of microscopic systems such as electrons and molecules, nermodynamics provides systematic description of macroscopic properties and characteristics, and statistical nermodynamics makes links between microscopic and macroscopic properties. The lectures will also focus n how quantum theory serves as a basis for understanding electron configuration in atoms, chemical bonds, oliceular structure, and various spectroscopic properties.	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]
Course objectives]	[Evaluation method] Evaluation will be based on an examination (80%) and class performance (20%).
tudents will understand quantum theory systematically, which provides the fundamental laws of the olocular world. Students will also become able to explain, on the basis of quantum theory, electron onfiguration in atoms, chemical bonds, molecular structures, and various spectroscopic properites.	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.
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 	[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 1 0 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 8 版 (下) ご (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)
i) Molecular structure (2 classes) Valence bond method, molecular orbital method	[References, etc.]
Valence bold memory, molecular orbital memory Polyatomic molecular system orbitals Molecular spectroscopy 1 (2 classes) Rotational spectrum Vibrational spectrum	(Reference books) Introduced during class To be introduced during the course [Study outside of class (preparation and review)]
i) Molecular spectroscopy 2 (1 class) Electron transition	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.
5) 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)(3)	Course number U-ENG27 37126 LJ60

(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.		最先端機器分析(Advanced Instrumental A		hemistry) and c	ructor's e, job title, department filiation	Professor,O Graduate Sc Associate Prof Graduate Sc	hool of Engineering TSUKA KOJI hool of Engineering essor,OYAMA MUNETAK. hool of Engineering ofessor,KUBO TAKUYA
	Target year	3rd year students or a	bove Number	of credits 2	2 Yea	r/semesters	2021/Second semester
	Days and period	ds Fri.1 CI	ass style	Lecture		Language of instruction	Japanese
	[Overview a	and purpose of t	he course]	1			
	were not deal		ntal Analysis (Frontier Chen			nd some methods which addition, the advanced
	[Course ob	jectives]					
	Understand th edge analysis		plications of a	dvanced instr	rumental ana	lysis methods	s as well as the cutting-
	[Course sc	hedule and cont	ents]				
	of micro/nanc focusing on ci 2. Electroche analysis meth (voltammetry 3. Spectral an coupled plasn 4. Spectral an Raman spectr 5. Topics (1): 6. Confirmatie lecture.	o-scale separation a apillary electrophoi mical analysis (4): loods for electrolytic ol and current measu- lalysis I (1): Princip na spectroscopy. lalysis II (4): Basic cophotometry, mass Advanced instrum	nalysis method resis and micro Principles, me redox reaction arement metho les and measu theory, princip spectrometry, ental analysis	ds, which have schip electrop assurement me ts, such as pot ds (amperom- rement metho ble, equipmen and nuclear r method.	re been rapidl phoresis tethods, and r tential and content tetry). ods of atomic nt and applica magnetic reso	y developing esponse beha urrent measur spectroscop tions of infra onance spectr	wior of electrochemical rement methods y and inductively red spectrophotometry,
		: learned both "Ana ntier Chemistry)" i					ed Instrumental 審機署分析(創成化学)(2)↓↓
L	 						

Graduate School of Engineering Professor,OTSUKA KOJI Graduate School of Engineering Associate Professor,OYAMA MUNETAKA Graduate School of Engineering Associate Professor,KUBO TAKUYA

员先端機器分析(創成化学)(2)	c
[Evaluation methods and policy]	4
Evaluation will be based on assignments (80%) and class performance (20%).	
[Textbooks]	4
Daniel C. Harris 『Quantitative Chemical Analysis, 10th Ed.』 (W. H. Freeman, 2020) ISBN:	1
781319324506	Con (an title
[References, etc.]	En
(Reference books) ntroduced during class	
[Study outside of class (preparation and review)]	1
ntroduced during class if necessary.] L
(Other information (office hours, etc.))	Tar
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Course n	umbe	r U-EN	G27 4	7127 LJ61						
Course title (and course title in English)		のフロンデ tier Chemistr				nan and	ructor's ne, job ti departn ffiliation	tle, nent	Professor,OC Graduate Scl Professor,OT Graduate Scl Professor,N/A Graduate Scl Professor,N/A Graduate Scl Professor,MI Graduate Scl Professor,TA Institute for I Professor,TA Institute for C Associate Pro Graduate Scl	aool of Engineering DUCHI MAKOTO DOUCHI MAKOTO DOI of Engineering SUKA KOJI Dool of Engineering KKAO YOSHIAKI Jool of Engineering KAMURA YOU Johan Arts and Sciences NAKA KATSUHISA NoAKA KATSUHISA NoAKA KATSUHISA DOI of Engineering KENAKA MIKIHITO Chemical Research Ofessor,OONO KOUJI Jool of Engineering JMATA KEIJI ngineering
Target yea	arget year 4th year students or above Number of credits 2 Year/semesters 2021/First semester									
Days and peri	nd periods Fri.4 Class style Lecture Language distinction Japanese									
Advanced r understand the other on are posted s [Course of Students wi	[Overview and purpose of the course] Advanced research being performed in frontier chemistry research labs will be explained in an easy-to- inderstand way by researchers themselves. This is a concentrated course: Two classes will be held one after the other on Friday aftermoons 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 we	areas, as well as of likely future trends. Students will also understand the role that chemistry plays in society.									mistry plays in society.
-	[Course schedule and contents]									
As macromethese lecture self-organiz	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.									
An overview	'rontlines of polymer synthesis (2 classes) An overview explanation is provided of basic chain polymerization functions, methods of precise synthesis of nacromolecules via chain polymerization, and the characteristics of polymers thus precisely synthesized.									

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s of macromolecular design (2 classes) y for the rational design and synthesis of macromolecules is indispensable to activities that aim to y grant new functions to polymers. Students will gain a deeper understanding of the fundamentals Continue to 化学のフロンティア(創成化学)[2]↓↓↓

化学のフロンティア(創成化学)(2)

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 each type of macromolecule (polymer).

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

rontlines 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, organic 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)

_____ Continue to 化学のフロンティア(創成化学)(3)↓↓↓

化学のフロンティア(創成化学)(3)

[Study outside of class (preparation and review)] Assignments and individual reports will be appropriately instructed during classes.

(Other information (office hours, etc.))

ourse contents may be changed as necessary.

*Please visit KULASIS to find out about office hours

(and course) [L-F-:XP:F] (and department of affiliation Institute for Fronter Life and Medical Sciences English) Chemical Biology (and department of affiliation Institute for Fronter Life and Medical Sciences Farget year ind year students or above Number of credits 2 Year/semesters 2021/Second semester Days and periods Thu.2 Class style Lecture angue distudent 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. Immunology, and endocrine disruptor of life science application. [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, re	e requirements]
and course its in ingitish) 化学生物学 Chemical Biology name, job title, and department of affiliation Institute for Froniter Life and Medical Sciences Professor, EIRAKU GENJI Institute for Froniter Life and Medical Sciences Associate Professor, OHGUSHI MASATOSHI arget year Ind year students or above Thu.2 Class style Lecture Impage distance ays and periods Thu.2 Class style Lecture Impage distance Overview and purpose of the course] Impage distance Impage distance is important in the field of life science to understand biochemistry and biological medicine in terms of reganic material chemistry. The way to think and view the biological system and bioprocess at the molecular revel can make clear the academic knowledge of life science and contribute to the development of negineering-medicine-pharmacy interdisciplinary research area. In this lecture, proteins, polysaccharides, and pids of bio-related substances as well as cells, cell membrane, extracellular matrix of biogical system are tardisciplinary research area, drug delivery system (DDS) and regenerative medicine are introduced. In diocrime disruptor, are also covered. Course objectives I the objective of the lecture is to obtain the fundamental knowledge of proteins, polysaccharides, lipids, cells, ned extracellular matrix and understand stem cells, body defense, DDS, regenerative medicine, and endocrine isruptor of life science application. Course objectives I the objective of the lecture is to obtain the function of polysaccharides and lipids, lead and instruction and ce	prequirements]
the in ngitish) Chemical Biology and department of affiliation Professor,EIRAKU GENJI Institute for Frontier Life and Medical Sciences Associate Professor,OHGUSHIMASATOSHI Note and purpose of the course is associate Professor,OHGUSHIMASATOSHI arget year rd year students or above Number of credits 2 Year/semesters 2021/Second semester ays and periods Thu.2 Class style Lecture imput institute of rediscore in terms of grant material chemistry. The way to think and view the biological system and bioprocess at the molecular segnerative in the field of life science to understand biochemistry and biological system and biograces as well as cells, cell membrane, extracellular matrix of biological system are plained in terms of chemical biology. As a representative of engineering-medicine-pharmacy interdisciplinary research area. In this lecture, proteins, polysaccharides, and pidocrine disruptor, are also covered. Course objectives] Imput institute of life science, including stem cells, body defense and immunology, and idocrine disruptor, are also covered. Course schedule and contents] Imput institute of polysaccharides and lipids. ord extracellular matrix and understand stem cells, body defense, DDS, regenerative medicine, and endocrine issuptor of life science application. Course schedule and contents] Immunology and finids. ody defense and lipids, time, Structure and function of polysaccharides and lipids Immunology in the science application of stem cells ody defense a	
nglish) of affiliation Institute for Frontier Life and Medical Sciences Associate Professor.OHGUSHI MASATOSHI arget year arget year ard year students or abov Number of credits 2 Year/semesters 2021/Second semester arget year ard year students or abov Number of credits 2 Year/semesters 2021/Second semester arget year and periods Thu2 Class style Lecture unpup distudie Japanese Overview and purpose of the course] is important in the field of life science to understand biochemistry and biological medicine in terms of ganic material chemistry. The way to think and view the biological system and biological system and biological system are toplained in terms of chemical biology. As a representative of engineering-medicine-pharmacy terdisciplinary research area, drug delivery system (DDS) and regenerative medicine are introduced. In diftion, some topics in the field of life science, including stem cells, body defense and immunology, and didocrine disruptor, are also covered. Course objectives] Immediate stem cells, body defense, DDS, regenerative medicine, and endocrine sruptor of life science application. Course schedule and contents] Immediate cell membrane, transportation of polysaccharides and lipids ell and cell membrane, time, Structure and function of stem cells ell and extracellular matrix, ltime, Overview of DDS based on material science and immunology, ltime, Overview of BDS based on material science rug delivery system (DDS), ltime, Overview of of bDS based on mate	
arget year Brd year students or abov Number of credits 2 Year/semesters 2021/Second semester ys and periods Thu.2 Class style Lecture Japanese Dverview and purpose of the course] is important in the field of life science to understand biochemistry and biological medicine in terms of ganic material chemistry. The way to think and view the biological system and bioprocess at the molecular vel can make clear the academic knowledge of life science and contribute to the development of gineering-medicine-pharmacy interdisciplinary research area. In this lecture, proteins, polysaccharides, and joids of bio-related substances as well as cells, cell membrane, extracellular matrix of biological system are plained in terms of chemical biology. As a representative of engineering-medicine-pharmacy terdisciplinary research area, drug delivery system (DDS) and regenerative medicine are introduced. In difficient, some topics in the field of life science, including stem cells, body defense and immunology, and docrine disruptor, are also covered. Course objectives] me objective of the lecture is to obtain the fundamental knowledge of proteins, polysaccharides, lipids, cells, del axtracellular matrix and understand stem cells, body defense, DDS, regenerative medicine, and endocrine sruptor of life science application. Course schedule and contents] ((if secience application. cotins and enzymes, 2times, Structure and function of polysaccharides and lipids (if secience application at cell membrane, extracellular matrix gand immunology, thime, System and function of extracellular matrix generative medicine, nuembrane, extracel	
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Course number U-ENG27 37130 LJ62 U-ENG27 37130 LJ61									
Course title (and course httle in English) 高分子化学 I Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,OOUCHI MAKOTO									
Target year Brd ye	ear Brd year students or above Number of credits 2 Year/semesters 2021/Second seme								
Days and periods Wed.	ays and periods Wed.1 Class style Lecture Language distinction Japanese								
[Overview and pu	rpose of the	course]							
polymerization), this	course is to dis tionic), ring-op	cuss the co ening, and l	ncepts and living polyi	the chara nerizatio	acteris ons. Er	tics of coordin kamples are p	ndensation and radical nation, stereospecific, rovided for initiators, s.		
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their synthesis (polyr	merization react	tions).	mistry, part	ticularly	the fu	ndamental nat	ture of polymers and		
[Course schedule	and content	s]							
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 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 polymerization). 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 anionic 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 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									
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高分子化学 | (2)

未更新

[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 selflearning.

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[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-ENG27 27132 LJ55 U-ENG27 27132 L		化学数学(創成化学)(2)
	5501	
Course title Instructor's	Graduate School of Engineering	[Textbooks]
(and course 化学数学(創成化学) name, job tit title in Mathematics of Chemistry(Frontier Chemistry) and departm		[
English)	Associate Professor,OGAWA HIROKI	
		[References, etc.]
arget year 2nd year students or above Number of credits 2	Year/semesters 2021/Second semester	(Reference books)
Days and periods Tue.2 Class style Lecture	Language of instruction Japanese	
[Overview and purpose of the course]		
		[Study outside of class (preparation and review)]
[Course objectives]		
Footige oplogradel		(Other information (office hours, etc.))
		*Please visit KULASIS to find out about office hours.
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[Course requirements]		
None		
[Evaluation methods and policy]		
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Course title (and course title in English)			37133 LJ60						
		学(創成化学 tion Chemistry		emistry)	name and d	ictor's , job tit epartm iliation		Professor,FU Institute for I	nool of Engineering JJITA KOJI Liberal Arts and Sciences NAKA KATSUHISA
Target yea	r 3rd ye	ear students or abov	Number	of cred	its 2		Yea	r/semesters	2021/Second semester
Days and perio	ods Mon.	1 Clas	s style	Lecture	e			Language of instruction	Japanese
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[Course o	bjective	s]							
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Acids and ba			lisj						
Students are	given ex hard acid	planations of sand bases an							ls and bases, the ds, and acid - base
Explanation: such as redu	s are give		ncepts of oxi equation, La	atimer di	agrar	ns, Fro	ost dia		organic compounds, aix diagrams, the
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		ordination con				and su			
Explanation				the stru	cture	und sy	mmet	ry of complex	tes, the nomenclature

錯体化学(創成化学)(2)

Confirmation of learning achieved, 1 session Here, the students' understanding of the lecture contents is confirmed.

[Course requirements]

Students are required to have knowledge obtained in Basic Inorganic Chemistry.

[Evaluation methods and policy] Evaluation is based on results from regular examinations.

[Textbooks]

Others; Weller, M., et al. (translated by Tanaka, K., Takahashi, M., Abe, T., Hirao, K., Kitagawa, S.), Shuraibaa atokinsu muki kagaku dai 6-ban (ue), (Tokyo Kagaku Dojin, 2016), ISBN: 978-4-8079-0898-1) isbn {} (9784807908981); Weller, M., et al. (translated by Tanaka, K., Takahashi, M., Abe, T., Hirao, K., Kitagawa, S.), Shuraibaa atokinsu muki kagaku dai 6-ban (shita), (Tokyo Kagaku Dojin, 2017), ISBN:978-4-8079-0899-8) isbn{} (9784807908998}

[References, etc.]

(Reference books) Others; Hirao, K., et al., Muki kagaku - sono gendai-teki apuroochi - dai 2-ban, (Tokyo Kagaku Dojin, 2013) isbn {} {9784807908240}

[Study outside of class (preparation and review)]

Before attending a lecture, students must prepare by reading the textbooks; after attending a lecture, students will review the material by solving exercises in the textbooks.

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

Course number U-ENG27 37134 LJ61 U-ENG27 37134 LJ62	Course number U-ENG27 37135 EJ61
Course title (and 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 Associate Professor, OGAWA HIROKI Target year Bid year students or above Number of credits 2 Year/semesters 2021/Second semester Days and periods Fri.2 Class style Lecture Impaged instudent Japanese [Overview and purpose of the course] [Course objectives] Impaged instructor Impaged instructor	Course title (and course title in English) 創成化学実験 I (創成化学) Instructor's Frontier Chemistry Laboratory I(Frontier Chemistry) Instructor's and papartment of affiliation Graduate School of Engineering Professor, TANAKA KAZUO Graduate School of Engineering Associate Professor, KUBD TAKUYA Graduate School of Engineering Associate Professor, KUBAHSHI TAKUYA Sasciate Professor, TERASHIM TAKUYA Graduate School of Engineering Associate Professor, TERASHIM TAKUYA Graduate School of Engineering Associate Professor, TERASHIMA TAKUYA Graduate School of Engineering Associate Professor, TERASHIMA TAKUYA Graduate School of Engineering Associate Professor, TERASHIMA TAKUYA Graduate School of Engineering Professor, FUTA KOLI Graduate School of Engineering Professor, FUTAK KOLI Graduate School of Engineering Professor, FUTAK KOLI Graduate School of Engineering Professor, FUTAK KOLI
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. Atimes, Atimes, 3times, ,1time, [Course requirements]	Target year Bird year students or above Number of credits 7 Year/semesters 2021/First semester Days and periods add year students or above Experiment Lagage distution Japanese
None	[Course objectives]
[Evaluation methods and policy] Grading	
[Textbooks] [References, etc.] (Reference books) [Study outside of class (preparation and review)]	[Course schedule and contents] /otimes, /otimes, /litimes, /9times, /9times, /15times, /0
(Other information (office hours, etc.))	
*Please visit KULASIS to find out about office hours.	
創成化学実験 I (創成化学)(2)	未更新 Course number U-ENG27 37136 EJ61 Graduate School of Engineering
[Course requirements] None [Evaluation methods and policy]	Professor,MATSUBARA SEDIROU Graduate School of Engineering Associate Professor,KUBO TAKUYA Graduate School of Engineering Associate Professor,KURAHASHI TAKUYA
[Textbooks]	Course title (and course English) 前成化学実験 II (前成化学) Instructor's (and course Frontier Chemistry Laboratory II(Frontier Chemistry) and particular (Frontier Chemistry) and particular (Frontier Chemistry) and particular (Frontier Chemistry) (Frontier Chemistry) (Frontier Chemistry) and particular (Frontier Chemistry) (Frontier Chemistry) and particular (Frontier Chemistry) (Frontier Chemistry) (Fron
[References, etc.] (Reference books)	Target year Brd year students or above Number of credits 7 Year/semesters 2021/Second semester Days and periods[m:343/m3451m34] Class style Experiment Laggaged instudents for Japanese
[Study outside of class (preparation and review)]	Days and periods Days and periods <thdays and="" periods<="" th=""> <thdays and="" periods<="" t<="" td=""></thdays></thdays>
(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.	[Course objectives]
[Courses delivered by instructors with practical work experience]	[Course schedule and contents] ,6times,
(1) Category A course with practical content delivered by instructors with practical work experience	, Juines, , 12times, , 3times,
(2) Details of instructors' practical work experience related to the course	,9times, ,15times,
(3) Details of practical classes delivered based on instructors' practical work experience	,6times, ,6times,
	[Course requirements] None

	未更新
創成化学実験 II (創成化学)(2)	Course number U-ENG27 37137 LE48 U-ENG27 37137 LE61
[Evaluation methods and policy]	Course title (and course title in English) 和学英語(創成化学) Instructor's Scientific English Instructor's name, job title, Scientific English Instructor's name, job title, and department of affiliation Instructor's name, job title, and and and and and and and and and and
[Textbooks]	Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester
	Days and periods Mon.3 Class style Lecture Language disturble English
[References, etc.]	[Overview and purpose of the course]
(Reference books)	
[Study outside of class (preparation and review)]	[Course objectives]
	[Course schedule and contents]
(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.	,1 time, , 4 times, , 4 times, , 5 times,
[Courses delivered by instructors with practical work experience] (1) Category A course with practical content delivered by instructors with practical work experience	[Course requirements] None
(2) Details of instructors' practical work experience related to the course	[Evaluation methods and policy]
(3) Details of practical classes delivered based on instructors' practical work experience	
	[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.

Course nu	umber	U-ENG27	37137 LE48	U-EN	IG2	7 37137	LE61		
(and course 科学英語(創成化学) title in Scientific English			nan and	tructor's ne, job ti I departn affiliation	nent	Graduate School of Engineering Professor,MATSUBARA SEIJIRO Part-time Lecturer,John Pryce			
Farget yea	r Brd ye	ear students or abo	ove Number	of cred	lits	2	Yea	r/semesters	2021/First semester
Days and perio	ods Mon.	4 Cla	ss style	Lectur	e			Language of instruction	Japanese
Overview	and pu	rpose of th	e coursel						
	passive	lecture course	oth oral and v				all on	iline classes a	nd actively participate
Industrial Cl To give stud listening, rea To develop a	f this cou hemistry. lents con ading, an and contr	rse are: 1. To 2. To impro- fidence in ora d writing, as ibute to the s	ve and expan al and present well as critica	d studer tation sk al thinki idence a	it's s ills. ng s nd k	pecializ 4. To d kills wi mowled	ed voo evelop th rega	cabulary and p student's ove ards to Industr	thin various aspects of ronunciation skills. 3. rrall ability in speaking, rial Chemistry topics. 5. nd international
 Introduc 	tion / Un		-				luction	1 to the course	objectives, how it will
2. Unit 1 -	3D Print	ing Material (Chemistry : (Continua	atior	n and co	mpleti	ion of unit 1.	
		- Studying V V1H approac		nunciatio	on, u	ise of sy	/nonyr	ms and effecti	ve summarisation
4. Unit 2 -	Virology	- Studying V	/iruses:Con	itinuatio	n an	d comp	letion	of unit 2.	
5. Video O	pinion 1	Assignment	Preparation:	Details	will	l be give	en in c	lass.	
							d for b		and creating titles for
	_			-		_	- (Continue to 科学	英語(創成化学)(2)↓↓

科学英語(創成化学)(2)

presentations/papers/assignments.

7. Unit 3 - Nanotechnology - Securing your Future : Continuation and completion of unit 3.

Unit 4 - Genetics -What does the future Hold : Pronunciation, topic keywords and the resolution of dilemmas using ethical and moral issues in science and technology.

9. Video Opinion 2 Assignment Preparation / Final Presentation Topic Selection : Details will be given in class.

10. Unit 5- DNA and Cloning -Real Carbon Copies/Video Opinion 2 Assignment Submission : Pronunciation, word association, note-taking and summarizing.

11. Unit 5- DNA and Cloning - Real Carbon Copies / Practice Presentation : Continuation and completion of unit 5

12. Unit 6 - Biomimicry - Nature as a solution : Pronunciation, topic keywords, Note-taking and marizing

13. Unit 6 - Biomimicry - Nature as a solution : Continuation and completion of unit 6.

- 14. Opinion 3 Assignment : This assignment will be conducted live in class.
- 15. Final Presentation : This assignment will be conducted live in class.

[Course requirements]

Students enrolled in the Industrial Chemistry Course of the School of Industrial Chemistry. All instruction will be in English, so students are advised to work on improving listening skills both before and during the course.

[Evaluation methods and policy]

Video Opinion 1-3 - 45% Practice Presentation - 10% Presentation Topic - 10% Final Presentation - 35%

[Textbooks]

Handouts can be downloaded from the resources tab on Panda. Additional materials such as rubrics, lecture presentations and supplementary materials can also be found there.

_____Continue to 科学英語(創成化学)(3)↓↓↓

	+
科学英語(創成化学)(3)	 大更新 Course number U-ENG27 37211 LJ61
[References, etc.] (Reference books) Nothing specified.	Course title (and course title in English)
[Study outside of class (preparation and review)]	Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester
othing specified.	Days and periods Thu.1 Class style Lecture Language distructor Japanese
(Other information (office hours, etc.))	[Overview and purpose of the course]
lothing specified.	
	[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.

Course numb	U-EN	G27 37220 LJ61	U-ENG	27 37220	LJ55			
Course title (and course title in English)		thod in Chemistr	v∏ a	nstructor's name, job ti and departn of affiliation	nent	Fukui Institute for Fundamental Chemistry Professor,SATOU TOORU Graduate School of Engineering Assistant Professor,NAKANO HIROSH Institute for Chemical Research Professor,MIZUOCHI NORIKAZU		
arget year	3rd year students	or above Number	of credit	:s 2	Year	/semesters	2021/First semester	
Days and periods	Fri.1	Class style	Lecture			Language of instruction	Japanese	
Overview an	nd purpose o	f the course]						
[Course obje	ctives]							
[Course sche	edule and co	ntents]			_			
2times,								
1time, 3times,								
ltime,								
4times, 3times,								
1 time.								
[Course requ	irements]							
None								
[Evaluation r	nethods and	policy]						
[Textbooks]								
	etc.]							
[References,								
[References, (Reference	books)							
• ·	books)							
(Reference		preparation and	d review)]				
(Reference		preparation and	d review)]				
(Reference	de of class (preparation and e hours, etc.))	d review)]				
(Reference [Study outsid	de of class (j mation (offic	-)]				

						未更新	
Course number	U-ENG27 27300 LJ60						
	md course hle in 物理化学 I (化学工学) Physical Chemistry I (Chemical Engineering)			r's o title, rtment on	Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Associate Professor,MAKI TAISUKI Graduate School of Engineering Associate Professor,TANABE KATSUAK		
Target year 2nd y	year students or above Number of	of credit	t s 2	Yea	r/semesters	2021/Second semester	
Days and periods Wed.	.2 Class style	Lecture			Language of instruction	Japanese	
[Overview and pu	urpose of the course]						
	an essential subject to learn gineering thermodynamics.		il engine	ering. T	his class prov	ides an elementaly	
[Course objective	•						
The goal is to learn t	he way to apply the basics	of thermo	odynaai	es to che	mical process	caluculations.	
[Course schedule	e and contents]						
Thermochemistry, I. 3. The Second Low of 7 Confirmation of the 1 Balance for Open Sy Thermodynamic Prop Phase Equilibrium, It Application of Therm Confirmation of the 1 [Course requirem	Thrmodynamics,2times, Level of Attainment 1,1ti rstems,2times, perties of Fluids,2times, time, nodynamics to Industrial Pi Level of Attainment 2,1ti	rocesses , ime,	,2times,				
[Evaluation meth	ods and policy]						
•	d by reports (homeworks)	and exam	nination	s.			
	2. Van Ness : Introduction t aational) isbn{} {978125969		cal Engi	-			
					Continue to 物理	化学 (化学工学) (2) ↓ ↓ ↓	

物理化学 I (化学工学)(2)	Course number U-ENG27 27301 LJ60 未更新
[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.	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, SAKKA TETSUO Instructor's name, job title, and department of affiliation
(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.	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second semester
*Please visit KULASIS to find out about office hours.	Days and periods Mon.2 Class style Lecture Language of instructor Japanese [Overview and purpose of the course]
[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	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]
(3) Details of practical classes delivered based on instructors' practical work experience	[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]
	Continue to 無硬化デ I 「(化学工学)」(2)↓ ↓ ↓
無機化学 I (化学工学)(2)	Course number U-ENG27 27302 LJ55 U-ENG27 27302 LJ76
[Textbooks] Inorganic Chemistry (4th edition) P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong isbn{}{ 0199264635}	Course title (and course title in English) Course title (and course title in English)
[References, etc.] (Reference books) Supplemental explanation will be delivered at the first class.	Target year Indigen students or above Number of credits 2 Year/semesters 2021/Second semester Days and periods Thu. 1 Class style Lecture Laguage distution Japanese [Overview and purpose of the course] The course Lecture Laguage distution Laguage distution
[Study outside of class (preparation and review)]	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.
(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.	[Course objectives] To attain the mathematical knowledge and skill how to calculate a line, surface and volume integrals, and to calculate differentiations
[Courses delivered by instructors with practical work experience] (1) Category A course with practical content delivered by instructors with practical work experience	of scalar and vector fields, and to solve ordinal differential equations by using Laplace transformations. [Course schedule and contents] Vector Analysis, (7-times)
 (2) Details of instructors' practical work experience related to the course (3) Details of practical classes delivered based on instructors' practical work experience 	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, 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)↓↓↓

洋工学数学 I (化学工学)(2)	Course number U-ENG27 37303 LJ61 U-ENG27 37303 LJ76
ourse requirements] ic knowledge on differentiation, integral, matrix operations valuation methods and policy]	Course title (and course title in English) 流体系分離工学 Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Associate Professor,NAKAGWA KYI
de will be evaluated by (i) the examination at the end of semester and (ii) homework during semester.	Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester
	Days and periods Thu.1 Class style Lecture Language distruction Japanese
日盛和『ベクトル解析 (理工系の数学入門コース 3)』(岩波書店)ISBN:4000077732 昊『ラプラス変換と常微分方程式』(昭晃堂)ISBN:4785670215	[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.
eferences, etc.]	phenomena to kineties and quantitative expression.
Reference books) 泰總夫『自然の数理と社会の数理』(日本評論社)ISBN:4535603014	[Course objectives]
* 心へ「日点(************************************	By taking typical separation operations as examples, mass balance, the students will understand the conce of mass transfer, and equilibrium, and they will master how to use them in quantitative manner. Additiona they cultivate their ability to use differential contact operation and stage operation.
udy outside of class (preparation and review)]	[Course schedule and contents]
er each class of vector analysis, homework is given to students, and their solution will be shown at the s in two weeks. highly recommended that students solve them before the class. Other information (office hours, etc.)) ease visit KULASIS to find out about office hours.	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 molect 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 operat 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 operat method.
	Feedback class (1time): A supplementary lecture or exercise class will be conducted as an additional class give advanced knowledge or to confirm the attainment level of the course goals on diffusion, gas absorpti and distillation.

	1
Course requirements]	
ntroduction to Industrial Chemistry (Material and energy balances), Fundamentals of Chemical Process ngineering,	
Evaluation methods and policy]	
valuation will be made based on midterm exam, routine exam at the end of semester, and reports often given 1 lectures.	
Textbooks]	
K. Hashimoto and F. Ogino 『Gendai Kagaku Kogaku』 (Sangyo Tosho)	
References, etc.]	
(Reference books)	
ntroduced during class	
Study outside of class (preparation and review)]	
tudents should check the contents of lecture beforehand and deepen their understanding by using text book nd reference book.	
(Other information (office hours, etc.))	
ecture will be given basen on the textbook. Exercise problems will be given to students to deepen	1
nderstanding in due course.	
Please visit KULASIS to find out about office hours.	

title in Physical Chemistry II (Chemical Engineering) and department Graduate School of Engineering											未更新
(and course Integration and Particle Part (化学工学) mame, job title, and department of affitiation Associate School of Engineering Assistant Professor, SUZUKI TETS Target year Prodyear students or abov Number of credits 2 Year/semesters 2021/First semester Days and periods Fri.2 Class style Lecture Image distort Japanese IOverview 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 quantu theory. ICourse objectives] Understand the phase-separation phenomenon of multi-component systems, and master how to read the pha diagrams. Further, understand the quantum theory, its difference and relation to the physical chemistry of multi-component liquids and gases: 8 times Physical chemistry of multi-component liquids and gases: 8 times Physical chemistry of molecules and solids: 6 times Feedback lecture: 1 time Image distort in the second state physical Chemistry [(Chemical Engineering)] IPeriods Image distort in the second state physical Chemistry [(Toth edition, Chaps. 4-10) IReferences, etc.] Image distort in the second state physical Chemistry I (Chemical Engineering). ICourse crequirements] Image distort in the second state physical Chemistry I (Chemical Engineering). ICourse crequirements]	Course nu	umber	U-ENC	327 37	304 LJ60						
Days of periods period	(and course 物理化学II(化学工学) title in Physical Chemistry II (Chemical Engineering)				ineering)	nar anc	ne, job ti I departn	nent	Associate Professor, T A N A B E K A T S U A K		
[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 quantu theory. [Course objectives] Understand the phase-separation phenomenon of multi-component systems, and master how to read the pha 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	Target yea	r Brd y	vear students o	r above	Number	of cred	lits	2	Year	/semesters	2021/First semester
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 quantu theory. [Course objectives] Understand the phase-separation phenomenon of multi-component systems, and master how to read the pha 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.] [Cutside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). [Cuther information (office hours, etc.])	Days and perio	ods Fri.2		Class	style	Lectur	e			Language of instruction	Japanese
component systems, etc. Also, you learn molecular and solid-state physical chemistry in the view of quantu theory.	[Overview	and p	urpose o	f the o	course]						
Understand the phase-separation phenomenon of multi-component systems, and master how to read the pha 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.] (References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	component s										
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.] [References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	[Course o	bjectiv	es]								
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.] [References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.,))	diagrams. Fu macroscopic	urther, u system	nderstand s.	the qu	antum the						
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.] [References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	•				•						
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.))	Physical che	emistry c	of multi-co	mpone	ent liquids	and gas	es: a	8 times			
[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.])	Physical che	emistry o	of molecul	es and	solids: 6 t	imes					
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.] [References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	Feedback le	cture: 1	time								
[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.))	-	•	-								
Final (end-term) exam score, etc. [Textbooks] Atkins 『Physical Chemistry』 (10th edition, Chaps. 4-10) [References, etc.] (References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.])	Assume the	complet	ion of Phy	sical C	Chemistry	I (Chem	ical	Engine	ering)		
Final (end-term) exam score, etc. [Textbooks] Atkins 『Physical Chemistry』 (10th edition, Chaps. 4-10) [References, etc.] (References, etc.] [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.])	[Evaluatio	n meth	ods and	polic	v]						
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.)) (Description)	-			•	,,						
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[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.))		-	homistr."	(10	th adition	Chana	4.14	2)			
(Reference books) [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	AUKINS #Ph	iysicai C	nemistry	(10	ui edition,	Cnaps.	4-10	J)			
(Reference books) [Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	Deference	oc oto	1					_			
[Study outside of class (preparation and review)] Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))	-		-								
Remind the contents of Physical Chemistry I (Chemical Engineering). (Other information (office hours, etc.))			JKJ /								
(Other information (office hours, etc.))	[Study ou	tside o	f class (p	repar	ration an	d revie	w)]				
	Remind the	contents	of Physic	al Che	mistry I (O	Chemica	1 Er	ngineerii	ıg).		
*Please visit KULASIS to find out about office hours.	(Other in	formati	on (office	e hou	rs, etc.))						
	*Please visit	KULA	SIS to find	l out al	bout office	hours.					

Course number	U-ENG27	37305 LJ55	U-ENG	27 37305	LJ76			
Course title (and course title in English)	学数学II atics for Chen	nical Engine	ering II a	nstructor's name, job t and depart of affiliatio	itle, ment	Graduate School of Engineering Associate Professor,NAGAMINE SHINSUK Graduate School of Engineering Associate Professor,TANIGUCHI TAKASF		
arget year Brd ye	ear students or abov	Number	of credit	t s 2	Yea	r/semesters	2021/First semester	
Days and periods Fri.1	Clas	s style	Lecture			Language of instruction	Japanese	
Overview and pu	Irpose of the	course]						
ubjects in the chemi Partial Differential E	ical engineerin quations.						n students will learn ourier Transformation,	
[Course objective	-							
			y mathen	natical kn	owledg	ge that is need	ed when students learn	
subjects in the chemi	icai engineerin	g course.						
[Course schedule	e and conter	ts]						
 -2. Conditional pro- -3. Stochastic varial (a) Probability d (b) Average, Exy (c) Moment gene (c) Moment gene (a) simultaneous (b) marginal and (c) covariance, c Probability and Statis 1-5. Various distribut (b) Poisson distr (c) Gauss distrib -6. Law of large nu Central limit the Normal distribut 	ble and its proj istribution fun pectation value erating functio variable case d distribution fit conditional pr porrelation coer stics, (2-times) tion function function function function function mbers orem	ction, e, Moment, n unction robability fficient ons ms						
Fourier Transformati 3-1. Fourier integral 3-2. Fourier transforr								
Partial Differential E 4. Fundamentals to se			ations					

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 3	7307 LJ61	U-ENG2	27 37307	LJ76			
Course title (and course title in English)	学II al Reaction Engineering II			astructor's ame, job tit nd departm f affiliation		Graduate School of Engineering Associate Professor,NAKAGAWA HIROYUK Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Senior Lecturer,ASHIDA RIYUUICH		
Farget year Brd y	ear students or above	Number of	f credits	5 2	Year	/semesters	2021/First semester	
Days and periods Mon.	.2 Clas	s style	Lecture			Language of instruction	Japanese	
[Overview and pu	urpose of the	course]				·		
Kinetic analysis and described.	reactor design	of heterogene	eous chen	nical reac	tions a	nd nonideal f	low reactors are	
[Course objective	es]							
Knowledge on the ki Knowledge on the de Ability to perform su	esign and opera	tion of variou	is reactor	rs, includi	ng noi	n-ideal flow re	eactors.	
[Course schedule	e and conten	ts]						
Gas-solid reactions a Solid-catalyst reaction Gas-liquid and gas-li ,1time,	ons and reactors	,3.5times,	and read	ctors,2tim	es,			
[Course requiren None	ients]							
[Evaluation meth	ode and poli	cvl						
-	ased on a mark		ritten ex	am, subm	ission	of quizzes co	nducted in class, and	
reports on assignmer								
		evised and au	gmented))』(Bait	fukan)	ISBN:97845	563046347	
reports on assignmer	n'no Kogaku (re	evised and au	gmented))』(Bait	fukan)	ISBN:97845	563046347	
reports on assignmer [Textbooks] K. Hashimoto 『Har	n'no Kogaku (re]	evised and au	gmented))』(Bait	îukan)	ISBN:97845	563046347	
reports on assignmer [Textbooks] K. Hashimoto THar [References, etc. (Reference boc [Study outside of	n'no Kogaku (re] oks) f class (prepa	aration and	review)]				
reports on assignmen [Textbooks] K. Hashimoto 『Har [References, etc. (Reference boc [Study outside of Read through the chainsufficient after the	n'no Kogaku (re]] [sks) f class (prepa apter of the text class.	iration and book by the c	review)]				
reports on assignmen [Textbooks] K. Hashimoto 『Har [References, etc. (Reference boc [Study outside of Read through the cha insufficient after the (Other informati	n'no Kogaku (re] oks) f class (prepa apter of the text class. on (office hor	ration and book by the o urs, etc.))	review) class start]				
reports on assignmen [Textbooks] K. Hashimoto 『Har [References, etc. (Reference boc [Study outside of Read through the chainsufficient after the	n'no Kogaku (re] oks) f class (prepa apter of the text class. on (office hor	ration and book by the o urs, etc.))	review) class start]				

(and course title in English)	目系分離工学 d-Phase Sepa	分離工学 hase Separation Engineering				ructor's e, job ti departn filiation	tle, nent	Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Associate Professor,NAKAGAWA KYUY.		
Target yea	r	3rd year students	or above	Number	of cred	its	2	Year	/semesters	2021/Second semester
Days and peri	ods V	Ved.2	Clas	s style	Lectur	e			Language of instruction	Japanese
-		d purpose o		-						
phenomena	, tran		ies, an	d methods t	o desig	1 sep	aration	opera	tions will be	ltiphase transport lectured. Especially, examples.
[Course of	bjec	ctives]								
multi-phase [Course s Adsorption	sepa che Oper	dule and co rations (4time	3) dev ontent s): Ad	reloping kno t s] sorption eq	uilibriu	n as	ecent tr	rends o	of separation librium, adso	materials used for techniques.
lectured.	. r									
transport of	heat		gas-liq	uid interfac	tion ope	eratio	on will	be lect	ured as exam	ping column will be ple of simultaneous a of wet-bulb
transport of temperature Drying Ope	heat and ratio	and mass at g how to use h ns (4times): 1	gas-liq umidit The me	uid interfac y chart. echanisms a	tion ope e. The s nd kine	eratio tude	on will nts will of dryin	be lect l under ng and	ured as exam stand the ide expertise to s	ple of simultaneous
transport of temperature Drying Ope drying unit Membrane	heat and ratio type Separ	and mass at g how to use h ns (4times): 1 will be lectur	gas-liq umidit The me ed, rel ions (3	uid interfac y chart. echanisms a ating opera stimes): Wit	tion ope e. The s nd kine tion con	eratio tude tics o ditio ain f	on will nts will of dryin ns with	be lect l under ng and n prope n the g	ured as exam stand the ide expertise to s rties of the d	ple of simultaneous a of wet-bulb elect and design the
transport of temperature Drying Ope drying unit Membrane s and process Crystallizati growth will	heat and ratio type Separ desig	and mass at g how to use h ns (4times): 1 will be lectur ration Operat gns of membro Operations (2t	gas-liq umidit The me ed, rel ions (3 rane se imes): wed by	uid interfac y chart. echanisms a ating opera stimes): Wit eparation pr The mecha t the explan	tion ope e. The s nd kine tion con th the m ocesses nism of ation or	tics of ditional ain f will the	on will nts will of dryin ns with ocus or be lect crystall popula	be lect l under ng and n prope n the g ured. lization tion ba	ured as exam stand the ide expertise to s rties of the d as separation and kinetic : lance require	ple of simultaneous a of wet-bulb elect and design the ried products.
transport of temperature Drying Ope drying unit Membrane s and process Crystallizati growth will apparatuses Feedback cl	heat and ration type Sepan desig ion C be le . Fina ass (and mass at a how to use h ns (4times): 1 will be lectur ration Operat gns of member Operations (2t ectured, follow ally, students'	gas-liq umidit The me ed, rel ions (3 rane se imes): wed by under	uid interfac y chart. echanisms a ating opera Btimes): Wif eparation pr The mecha the explan standing or entary lectur	tion ope e. The s nd kine tion con th the m ocesses nism of ation or the cou	eratic tude tics o ditio ain f will the urse v ercise	on will nts will of dryin ns with occus on be lect crystall popula will be e class	be lect l under ng and n prope n the g ured. lizatior tion ba tested. will be	ured as exam stand the ide expertise to s rties of the d as separation and kinetic : lance require conducted a	ple of simultaneous a of wet-bulb elect and design the ried products. , permeability equations analysis of the crystal
transport of temperature Drying Ope drying unit Membrane : and process Crystallizati gorowth will apparatuses Feedback cl give advance [Course r	heat and ration type Separ desig ion C be le . Fina ass (equi	and mass at a how to use h ns (4times): '1 will be lectur ration Operat gns of membi Operations (2t ectured, folloo ally, students' 1time): A sup nowledge or t	gas-liq umidit The me ed, rel ions (3 cane se imes): wed by under opleme o cont	uid interfac y chart. echanisms a ating opera stimes): Wii eparation pr The mecha v the explan standing or entary lectuu firm the atta	tion ope e. The s nd kine tion con th the m occesses nism of ation or the cou re or ex-	tics of ditional fractional fractions and fractional fr	on will nts will of dryin ns with occus or be lect crystall popula will be e class l of the	be lect I under og and h prope n the gg ured. ization tion ba tested. will be course	ured as exam stand the ide expertise to s rties of the d as separation and kinetic : lance require conducted a	ple of simultaneous a of wet-bulb elect and design the ried products. , permeability equations analysis of the crystal ed for the design of

固相系分離工学(2)	Course number U-ENG27 37309 LJ60
	Course title Instructor's
Fluid-Phase Separation Engineering	(and course 物理化学III (化学工学) name, job title, Graduate School of Engineering
Product Constant and a Park	tittle in Physical Chemistry III (Chemical Engineering) and department of affiliation Professor, MIYAHARA MINORU
[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.	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester
[Textbooks]	Days and periods Tue.1 Class style Lecture Language distinution Japanese
K. Hashimoto and F. Ogino 『Gendai Kagaku Kogaku』(Sangyo Tosho) H. Tamon 『Kanso Gijutu Jitsumu Nyumon』(Nikkan Kogyo Shinbun)	[Overview and purpose of the course]
H. Tamon «Kanso Gijutu Jitsumu Nyumon) (Nikkan Kogyo Shindun)	Thermodynamics is an important foundation of chemical engineering that is difficult to understand intuitively.
	To understand thermal phenomena intrinsically, observing them on a microscopic level is effective and provides indispensable knowledge for various advanced technologies such as nanotechnology. In this subject,
[References, etc.]	students are taught the basics of statistical thermodynamics and are given the chance to deeply understand
(Reference books)	and apply entropy and free energy, which are difficult to comprehend through macroscopic theory alone.
Introduced during class	[Course objectives]
	To understand the relationship between number of states and the probability of the emergence of states that
[Study outside of class (preparation and review)]	lie behind entropy and free energy, and to acquire the ability to formulate molecular models for simple systems, such as lattice systems, using various ensembles
Students should check the contents of lecture beforehand and deepen their understanding by using text book and reference book.	
and reference book.	[Course schedule and contents]
(Other information (office hours, etc.))	Fundamental laws of classical thermodynamics, 3 sessions The "difficulty" of the second law, entropy, and free energy, in particular, are again recognized.
Lecture will be given basen on the textbook. Exercise problems will be given to students to deepen understanding in due course.	
÷	Probability, distribution of states, and thermodynamic limit, 1 session Students are given an explanation of how the random motion of each molecule is connected to the
*Please visit KULASIS to find out about office hours.	thermodynamic state observed using a simple continuous system as an example.
	Microcanonical ensembles and entropy, 1 session
	Distribution of the number of states under a constant gross energy, S=klnW, dS/dE=1/T and its interpretation
	Entropy of ideal gas, Boltzmann distribution, and velocity distribution, 1.5 sessions
	Phase spaces and quantity of states, deriving the entropy of ideal gas via S=klnW, distribution of energy
	states
	Canonical ensembles and partition function, 1.5 sessions
	Study of the energy distribution of subsystems connected to a heat bath, partition function, Helmholtz free energy in a system at constant (V, T), Gibbs free energy in a system at constant (p, T)
	energy in a system at constant (v, 1), onoos iree energy in a system at constant (p, 1)
	Exercises, 1 session
	For microcanonical ensembles and canonical ensembles, students will work on the formulation of thermodynamic states based on molecular physical properties. Students must attend this session as it is
	important for their evaluation. Depending on the progress made in this session, an additional session may be held for exercises.
	Continue to 釉理化学Ⅲ(化学工学)(2)↓↓↓

物理化学Ⅲ(化学工学)(2)

Grand canonical ensembles and chemical potential, 2 sessions Study of open systems, grand partition function, chemical potential, examples of application

Classical statistical approximation and configuration integral, 1 session Students are given an explanation of the configuration integral and expression of partition functions, which are formulated via classical approximation of the number of states in a phase space. In addition, students are taught about the relationship between the configuration integral and thermodynamic quantity.

Non-ideal systems and intermolecular interactions, 2 sessions

In real systems, non-ideality is expressed through intermolecular interactions. As a result of these interactions, imperfect gas is produced and the gas-liquid transition occurs. Hence, the approach to handling such outcomes is explained to students in these sessions. In addition to the typical interaction potential function, students are taught that molecular simulation is significant as it allows the configuration integral to be obtained directly, and are given an outline on how to obtain thermodynamic quantities via molecular simulation.

Confirmation of learning achieved, 1 session

Here, the students' understanding of the contents of lectures will be evaluated and confirmed.

[Course requirements]

Physical Chemistry: Fundamentals and Exercises & Physical Chemistry I (Chemical Engineering)

[Evaluation methods and policy]

In addition to the end-of-term examination, students are also evaluated based on exercises and short tests conducted when necessary.

[Textbooks]

Others; none

[References, etc.]

(Reference books)

Kubo, R., Shinsou-ban: Toukei rikigaku, (Kyoritsu Shuppan, 2003) isbn {} (9784320034235);
 Widom, B. (translated by Koga, K.), Kagaku-kei no toukei rikigaku nyuumon, (Kagaku-Dojin, 2005) isbn {}

[47:59809505];
Doi, M., Butsuri no kangaekata 2: Toukei rikigaku, (Asakura Shoten, 2006) isbn {} {9784254137422}

[Study outside of class (preparation and review)]

After a teaching session, students must review it to deepen their understanding. In addition, students must prepare any questions that they may have and ask them at the beginning of the next teaching session.

_____Continue to 物理化学tll (化学工学) (3)↓↓↓

物理化学Ⅲ(化学工学)(3)

(Other information (office hours, etc.))

Students are given many short tests (quizzes). Exercises are also important for the students' evaluation. Hence, they must attend the session where exercises are given.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

Course nu	umber U-ENG27 37312 EJ61 U-EN	G27 37312 EJ76		化学プロセス工学実験I(化学工学)(2)			
Course title and course title in English)	化学プロセス工学実験 I (化学工学) ChemicalProcessEngineeringLaboratoryl(Chemical Engineering)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor, SANO NORIAKI Graduate School of Engineering Associate Professor, NAKAGAWA KYUYA Graduate School of Engineering Assistant Professor, SUZUKI TETSUO Graduate School of Engineering Senior Lecturer, ASHIDA RIYUUICHI Graduate School of Engineering Assistant Professor, HIRAIDE SYOTARO Graduate School of Engineering Assistant Professor, MURA LOPEZ, John Jairo Graduate School of Engineering Assistant Professor, HIKIMA YUUTA Graduate School of Engineering Assistant Professor, FINAMA YUUTA Graduate School of Engineering Assistant Professor, FONOMURA 05AMU Graduate School of Engineering	[Course requirements] Fundamentals of Chemical Process Engineering, Physical Chemistry I (Chemical Engineering), Fund 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)			
arget vear	Brd year students or above Number of cree		Assistant Professor,MURAŇAKA YÖSUKE Graduate School of Engineering Assistant Professor,MARUYAMA HIROYUKI Faculty of Engineering 化学工学実験関連教員	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.(N isbn{} {0071247084}			
arget yea	ar Brd year students or above Number of cred	lits 5 Yea	ar/semesters 2021/First semester	[Study outside of class (proparation and review)]			
			2021/1 list sellester	[Study outside of class (preparation and review)] Preparation of each lecture is highly recommended.			
Days and perio	iodsThu.3,4,5,Fri.3,4,5Class style Experi		anyage of instruction Japanese	Preparation of each lecture is highly recommended.			
)ays and perio [Overview		ment	Language d'instruction Japanese				
Days and period Days and period Deprimentation Depr	iods Thu.3,4,5,Fri.3,4,5 Class style Experi x and purpose of the course] Ial training on chemical analyses (gravimetr agineering (physical chemistry, transport ph	iment	Language of instruction Japanese	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and period Doverview Experimenta Schemical en [Course o	iods Thu.3,4,5,Fri.3,4,5 Class style Experi w and purpose of the course] lal training on chemical analyses (gravimetr ngineering (physical chemistry, transport ph objectives]	iment ic analysis, titrati enomena, reactio	Laguage distinction Japanese	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and period Deverview Experimentation themical en [Course o This course	iods Thu.3,4,5,Fri.3,4,5 Class style Experi x and purpose of the course] tal training on chemical analyses (gravimetr igineering (physical chemistry, transport ph bbjectives] will enhance studentsrsquo understanding	iment ic analysis, titrati enomena, reactio	Laguage distinction Japanese	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and period [Overview Experimental chemical en [Course of This course engineering.	iods Thu.3,4,5,Fri.3,4,3 <mark>Class style</mark> Experi x and purpose of the course] Ial training on chemical analyses (gravimetr agineering (physical chemistry, transport ph objectives] will enhance studentsrsquo understanding t	iment ic analysis, titrati enomena, reactio	Laguage distinction Japanese	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and period [Overview Experimentation chemical en [Course o This course engineering. [Course s	iods Thu 3,4,5,Fri.3,4,5 Class style Experi x and purpose of the course] Ial training on chemical analyses (gravimetr agineering (physical chemistry, transport ph objectives] will enhance studentsrsquo understanding s- schedule and contents]	iment ic analysis, titrati icenomena, reactio of quantitative ch	Language distinction ion analysis) and fundamentals of on engineering, etc.) nemical analysis and chemical	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and period [Overview Experimente chemical en [Course o This course engineering. [Course s Fundamenta filtration, vc chemical Ex Chemical Ex	ioos [hu.3,4,5,Fri.3,4,5 Class style Experi v and purpose of the course] tal training on chemical analyses (gravimetr igineering (physical chemistry, transport ph objectives] will enhance studentsrsquo understanding schedule and contents] als on chemical analyses, 15times, training re olumetric measurement, titration, etc. Stude operiments. ingineering I/Physical Chemistry, 14times, fr	iment ic analysis, titrati enomena, reactio of quantitative ch egarding glass too nt will also learn reezing point drop	Laguage distinction Japanese ion analysis) and fundamentals of n engineering, etc.) nemical analysis and chemical pls, electric balance, condensation, safety and waste management in p, Liquid-liquid equilibrium, gas-	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
lays and period (Overview, Experimenta hemical en (Course o This course ngineering, (Course s Vundamenta iltration, vc hemical ex Chemical En Guerra En Guerra En Guerra En Course o Course o Co	ioos [hu.3,4,5,Fri.3,4,5 Class style Experi v and purpose of the course] tal training on chemical analyses (gravimetr gineering (physical chemistry, transport ph objectives] will enhance studentsrsquo understanding scenedule and contents] als on chemical analyses, 15times, training re olumetric measurement, titration, etc. Stude operiments. ingineering I/Physical Chemistry, 14times, fri ibrium, measurement of gas diffusivity, fab ingineering I/Transport Phenomena,4times,	iment ic analysis, titrati enomena, reactio of quantitative ch egarding glass too nt will also learn reezing point drop rication of pH m viscosity and flov	Laguage distinction Japanese ion analysis) and fundamentals of on engineering, etc.) nemical analysis and chemical obs, electric balance, condensation, safety and waste management in p, Liquid-liquid equilibrium, gaster, surface tension and wettability w dynamics, pressure drop in liquid	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
Days and peri- [Overview Experimente themical en [Course o [Course o [Course o [Course s Fundamenta filtration, vc themical ex Chemical Er low reactor Chemical El low reactor	ides[hu.3,4,5,Fri.3,4,5 Class style Experi v and purpose of the course] Ial training on chemical analyses (gravimetr igneering (physical chemistry, transport ph bbjectives] will enhance studentsrsquo understanding s. schedule and contents] als on chemical analyses, 15times,training re olumetric measurement, titration, etc. Stude speriments. ingineering I/Physical Chemistry, 14times, fr ibrium, measurement of gas diffusivity, fab ingineering I/Transport Phenomena,4times, r	iment ic analysis, titrati enomena, reactio of quantitative ch egarding glass too nt will also learn reezing point drop rication of pH m viscosity and flov kinetic analysis ir	Lapuge distution Japanese ion analysis) and fundamentals of on engineering, etc.) nemical analysis and chemical ols, electric balance, condensation, safety and waste management in op, Liquid-liquid equilibrium, gaster, surface tension and wettability w dynamics, pressure drop in liquid a batch reactor, characterization of	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			
[Overview, Experimenta- chemical en [Course o This course en gineering, [Course s Fundamenta filtration, vc chemical ex Chemical En low Chemical En low reactor	iods [hu.3,4,5,Fri.3,4,3 Class style Experi v and purpose of the course] Ial training on chemical analyses (gravimetr agineering (physical chemistry, transport ph objectives] will enhance studentsrsquo understanding statistic students analyses, 15times, training re olumetric measurement, titration, etc. Stude typeriments. Ingineering I/Physical Chemistry, 14times, fri brium, measurement of gas diffusivity, fab ingineering I/Transport Phenomena,4times,4 ingineering I/Reaction Engineering,4times,4	iment ic analysis, titrati enomena, reactio of quantitative ch egarding glass too nt will also learn reezing point drop rication of pH m viscosity and flov kinetic analysis ir	Lapuge distution Japanese ion analysis) and fundamentals of on engineering, etc.) nemical analysis and chemical ols, electric balance, condensation, safety and waste management in op, Liquid-liquid equilibrium, gaster, surface tension and wettability w dynamics, pressure drop in liquid a batch reactor, characterization of	Preparation of each lecture is highly recommended. (Other information (office hours, etc.))			

Course n	umbe	u-ENG27 3	7313 EJ76	U-EN	G27	37313	EJ61		
Course title (and course title in English)		・ プロセス工学実! calProcessEngineeringLabora			nan and	ructor's 1e, job tit departn ffiliation		Professor,SA Graduate Sch Associate Profe Graduate Sch Assistant Prof Graduate Sch Senior Lectum Graduate Sch Assistant Profess Graduate Sch Assistant Profess Graduate Sch Assistant Profe Graduate Sch Assistant Profe Graduate Sch Assistant Profes Graduate Sch Graduate Sch Masistant Profes Graduate Sch	
arget yea	r	3rd year students or above	Number	of cred	its	5	Year	/semesters	2021/Second semester
Days and peri	odsW	ed.3,4,5,Thu.3,4,5 Clas :	s style	Experi	men	t		Language of instruction	Japanese
Overview	/ and	l purpose of the	course]						
		ining of chemical e ring, powder techno				ls(transj	oort ph	ienomena, sep	paration engineering,
[Course o	bjec	tives]							
				anding o	of ch	nemical	engine	eering, and the	e students will learn
ypical oper	ation	s in the experiment	s.						
-		dule and conten	-						
flow, mass t Chemical E absorption i Chemical E	ransp ngine n pac ngine	sort through interfa pering II/Separation ked bed tower, cyc erring II/Reaction E , , dynamic charact	ce Engineerin lone charac Ingineering	g,9time teristics and Pro	s,co for	ntinuou particle Contro	s distil sizes	llation, pressu	

化学プロセス工学実験II(化学工学)(2)

[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] (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{} {4503045187} Smith, Van Ness, Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Ed.(McGraw Hill) isbn{}{0071247084}

[Study outside of class (preparation and review)]

Preparation of each lecture is highly recommended.

(Other information (office hours, etc.))

*Please visit KULASIS to find out about office hours.

Course number	U-ENG	27 27314 LJ61	U-ENG27	27314 LJ76			1	化学工学量論(2)
title in Mater	工学量論 ial and energ	y balances	nam and	ructor's (ne, job title, P department (Professor,M. Graduate Scl Professor,K. Graduate Scl	hool of Engineering AE KAZUHIRO hool of Engineering AWASE MOTOAKI hool of Engineering		[Course requirements] Basic knowledge on thermodynamics lectured in Physical Chemistry: Fundamentals and Exercises, and Physical Chemistry I (Chemical Engineering) is required.
English)			ofa	C	Graduate Scl	ofessor,MAKI TAISUKE hool of Engineering		[Evaluation methods and policy]
					ssociate Professor	TANABE KATSÜAKI	1	Evaluation will be based on exercises at class, assignments, and an examination.
Target year 2n	d year students or	above Number	of credits	2 rear/s	semesters	2021/Second semester		[Textbooks]
Days and periods We	ed.1 C	lass style	Lecture		Language of instruction	Japanese		Masao Sudo ed. 『Kiso Kagakukogaku』 (Kyoritsu Shuppan) ISBN:9784320088702
[Overview and		-						
Balances of mass, fundamental of ch	volume, mole emical engine	e amount, and el ering. Physical	lements of si l and chemic	ubstances as we al principles wi	ell as balanc hich are req	e of energy is a uired for taking		[References, etc.]
material and energ	y balance in p	problems about	chemical pro	ocesses are lect	ured. How	to calculate the mass,		(Reference books)
component (eleme	nt), and energ	gy balance as for	r application	n processes is er	xplained and	1 practiced.		Some handouts are given at class.
[Course objecti	ves]						1	
						ce point of view as	1	[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
well as to cope wit	h design and	operation of ch	emical proce	esses quantitativ	vely.			As many exercises as possible will be imposed at class. Assignments will be imposed every week. Bring a scientific calculator to the class.
[Course schedu								(Other information (office hours, etc.))
Week 1: Dimensio measurement, and					hich are bas	ic concept of		*Please visit KULASIS to find out about office hours.
í í								
Weeks 24: Funda operations, express								
exercises.	sion of compe	5511011 01 1117.02	re, materiar	balance over a .	single uppur	atus, and men		[Courses delivered by instructors with practical work experience]
Weeks 56: Funda energy balance wit					ion of appar	ent and latent heats,		 Category A course with practical content delivered by instructors with practical work experience
								(2) Details of instructors' practical work experience related to the course
processes, and pro				arious unit opei	rations, prin	ciples of separation		
Weeks 910: Mate	erial and ener l reactions or	gy balance of co phase changes i	omplicated p	As well, how to	understand	balance of processes material balance in ned.		(3) Details of practical classes delivered based on instructors' practical work experience
Weeks 1113: Pra in complicated che				esses Calcula	tion of mate	erial and energy balance		
Weeks 14: Scale-u kinetics required fo			p apparatus i	is generally exp	blained as w	ell as introduction to		
Week 15: Learning	g achievemen	t evaluation.						
`				<u>-</u> Co	ontinue to	化学工学量論(2)↓↓↓		
							J	

Course n	umber	U	ENG27	37315 LE48	B U-EN	G27 3	7315	LE61		
		学英語(化学工学) entific English					ctor's job tit partm iation		Professor,MA	oool of Engineering ATSUSAKA SHUJI cturer,John Pryce
Target year		l year students or above Number c			of cred	credits 2 Ye			/semesters	2021/Second semester
Days and peri	n.3	Clas	s style	Lecture	,			Language of instruction	English	
[Overview	and a	ourpos	e of the	course]						
nternationa	l Comi							ents ca	in develop the	ir overall skills in
The goals of Chemical E skills. 3. To operations, j speaking, lis Engineering	f this congineer give st process stening topics	udents design readin . 5. To	To impro confidence and tech g and wr develop a	ve and expa ce in oral an nical descri ting, as wel nd contribu	and stude nd writter ptions in ll as, criti ite to the	ent#03 n comr Englis ical thi studer	9s spe nunic sh. 4. inking nt#039	ecializ ation To de skills 9s con	ed vocabulary skills regardir velop student s with regards	thin various aspects of and pronunciation tog technical data, unit #039s overall ability in to Chemical nowledge to be able to
Chemical E skills. 3. To operations, J speaking, lis Engineering attend interr [Course s Unit 1-15,tii sequenced to	f this congineer give st process stening topics hational chedu mes,Th p take t	burse ar ing. 2. udents design , readin , readin confer le cours he stud	To impro confidend and tech g and wr develop a ences, co l conten e is divid ents throu	ve and expa ce in oral an nical descri- ting, as well nd contribu- nduct prese ts] ed into 15 c agh key asp	and stude nd written ptions in Il as, criti- tte to the entations	ent#039 n comr Englis ical thi studer and pu ver 15 chemic	9s spe nunic sh. 4. inking nt#039 iblish week al En	ecializ ation To de skills s con paper s and gineer	ed vocabulary skills regardir velop student s with regards fidence and k s in English. the topics hav	e and pronunciation g technical data, unit #039s overall ability in to Chemical nowledge to be able to e been selected and with elementary
The goals of Chemical E skills. 3. To operations, J speaking, lis Engineering attend interr [Course s Unit 1-15,tin sequenced to specialized solution.	f this congineer give st process attening topics national chedu mes,Th o take t	burse ar ing. 2. udents design , readin . 5. To confer e cours he stud lary and	To impro confidend and tech g and wr develop a ences, co l conten e is divid ents throu	ve and expa ce in oral an nical descri- ting, as well nd contribu- nduct prese ts] ed into 15 c agh key asp	and stude nd written ptions in Il as, criti- tte to the entations	ent#039 n comr Englis ical thi studer and pu ver 15 chemic	9s spe nunic sh. 4. inking nt#039 iblish week al En	ecializ ation To de skills s con paper s and gineer	ed vocabulary skills regardir velop student s with regards fidence and k s in English. the topics hav	v and pronunciation g technical data, unit #039s overall ability in to Chemical nowledge to be able to e been selected and
The goals of Chemical E skills. 3. To operations, speaking, lis Engineering attend interr [Course s Unit 1-15, ti sequenced to solution. Week : 1 : U 2 : U 3 : U 3 : U	f this congineer give st process stening topics tational chedu mes,Th to take t vocabu The nit 1 N nit 1 N nit 2 M	nurse an ing. 2. udents design , readin . 5. To confer confer e cours he stud lary and me anotech aterials	To impro confidence and tech g and wri develop a ences, co I conten e is divid ents throu d pronunce mology mology Chemist	ve and expa e in oral an nical descri ting, as well nd contribu nduct prese ts] ed into 15 c igh key asp iation, culn	and stude nd written ptions in Il as, criti- tte to the entations	ent#039 n comr Englis ical thi studer and pu ver 15 chemic	9s spe nunic sh. 4. inking nt#039 iblish week al En	ecializ ation To de skills s con paper s and gineer	ed vocabulary skills regardir velop student s with regards fidence and k s in English. the topics hav	e and pronunciation g technical data, unit #039s overall ability in to Chemical nowledge to be able to e been selected and with elementary
The goals of Chemical E skills. 3. To operations, 1 Engineering attend interr ICourse s Ubrit 1-15,tin sequenced ti solution. Week : 1 : U 2 : U 3 : U 4 : U 5 : V 6 : U 7 : U 8 : U	this cdc and a second s	urse at a state of the study of	To impro confident and tech g and wri- develop a ences, co I conten e is divid ents thron d pronund mology nology Chemist Assessme hes in Cl	ve and expa e in oral an inclad descri- ting, as well and contribu- nduct prese ed into 15 c rgh key asp iation, culn ry ry ry nt Preparati	and stude d writter ptions in II as, criti the to the entations classes over eects of C ninating	ent#039 a comr Englisical thi studer and pu //er 15 chemic in tech	9s spe nunic sh. 4. inking tt#039 ublish week al En, nical	ecializ ation To de g skills Os con paper s and gineer troub	ed vocabulary skills regardir velop student s with regards fidence and k s in English. the topics hav	 and pronunciation g technical data, unit #/d39s overall ability in to Chemical nowledge to be able to
The goals of Chemical E skills. 3. To speaking, lis Engineering attend interr [Course s Unit 1-15, ti sequenced ti specialized solution. Week 1 U 2 U 3 U 4 U 5 V 6 U 7 U 8 U 9 U 10 P 11 U 12 U	this cc and the second	me antational and a me me anotech anotech anotech anotech anotech atterials atterials atterials atterials atterials atterials atterials atterials atterials	To impro- confidence and tech g and wri- develop a ences, co- co- co- ences, co- co- co- ents throo d pronund mology chemist Chemist Assessme Ch- hes in Cl- signment / Video	ve and expre e in oral an incal descri- titing, as wel nd contribu nduct prese tsj ed into 15 c igh key asp itation, culn ry ry ry ry nt Preparatii temical Eng	and stude d writter ptions in II as, criti te to the entations classes ov- eects of C minating ion gineering gineering	ent#039 a comr Englis ical thi studer and pu /er 15 chemic in tech	9s spe nunic sh. 4. inking tt#039 ublish week al En, nical	ecializ ation To de g skills Os con paper s and gineer troub	ed vocabulary skills regardir velop student with regards fidence and k is in English. The topics hav ing beginning le shooting an	 and pronunciation g technical data, unit #/d39s overall ability in to Chemical nowledge to be able to

科学英語(化学工学)(2)

[Course requirements]

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

[Evaluation methods and policy]

ssessment

- Week 6 Video Opinion Assignment 1 (10%) Week 11 Video Opinion Assignment 2 (10%) Week 14 Presentation Assignment (20%) Week 15 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.

	7315 LE48 U-ENG27	7 37315 LE61			
Course title (and course title in English)	namand	tructor's ne, job title, d department affiliation	Graduate School of Engineering Professor,MATSUSAKA SHUJI Part-time Lecturer,John Pryce		
Target year Brd year students or above	Number of credits	2 Year	/semesters	2021/Second semester	
Days and periods Mon.4 Class	s style Lecture		Language of instruction	English	
This course aims to give students an o Scientific context, specifically within English, the course focuses on creatin International Communication in both [Course objectives]	n the field of Chemical ing an environment whe	l Engineering. iere students ca	In addition, si	ince all instruction is in	
peaking, listening, reading and writin Engineering topics. 5. To develop and tittend international conferences, cond [Course schedule and contents] Jnit 1-15,times, The course is divided commended to take the divided to thereal	nd contribute to the stud nduct presentations and ts] ed into 15 classes over 1	dent#039s con l publish paper 15 weeks and	fidence and k rs in English. the topics hav	nowledge to be able to	
sequenced to take the students througl specialized vocabulary and pronuncia solution. Week : Theme 1 : Unit 1 Nanotechnology 2 : Unit 1 Nanotechnology 3 : Unit 2 Materials Chemistry 4 : Unit 2 Materials Chemistry 5 : Video Opinion Assessment 1 6 : Unit 3 Catastrophes in Chem 7 : Unit 3 Catastrophes in Chem 8 : Unit 4 Virology 9 : Unit 4 Virology 10 : Presentation Assignment Pr 11 : Unit 5 Genetics / Video Opi	ation, culminating in te y t Preparation rmical Engineering / Vi rmical Engineering	echnical troub	le shooting an		

(化学工学)(2) equirements] olled in the Chemical Process Engineering Course of the School of Industrial Chemistry on methods and policy] Video Opinion Assignment 1 (10%) Video Opinion Assignment 2 (10%) Presentation Assignment (20%) Final Written Exam (60%) s] ill be given each lesson. es, etc.] nce books) cified. d URLs) pecified.) tside of class (preparation and review)] on will be in English, so students are advised to work on improving listening skills both before he course. formation (office hours, etc.)) cified. KULASIS to find out about office hours

Course number U-ENG27 27400 LJ76 U-ENG27 27400 LJ61 Graduate School of Engineering Professor,MATSUSAKA SHUJI Graduate School of Engineering Professor, SANO NORIAKI Course title Instructor's 化学プロセス工学 [W202(創成)] name, job title, and department of affiliation Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Associate Professor,MAKI TAISUKE (and course title in Chemical Process Engineering English) Graduate School of Engineering Associate Professor,WATANABE SATOSH 2nd year students or above Number of credits Year/semesters 2021/Second semester Target year 12 Days and periods Wed.1 Class style Lecture arguage 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] ultivate 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 rocess control in chemical processes. In addition, students will develop the ability to quantitatively analyze hemical processes. [Course schedule and contents] 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. Distillation, 3 sessions These sessions will describe the correlation method of vapor-liquid equilibria, explain the basic principles of arious distillation operation methods for mixed liquid purification procedures, and explain the design nethod for a continuous rectification stage column, which is the simplest "multi-stage contact operation." 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 [W 2 0 2 〔創成〕] (2)↓↓

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.

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.

Course number U-ENG27 27400 LJ76 U-EN	NG27 27400 LJ61	化学プロセス工学[NS(先端)](2)
Course title (and course title in English) Chemical Process Engineering	Instructor's and department of affiliation Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Professor,SANO NORIAKI Ordewate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,MAKI TAISUKE Graduate School of Engineering Associate Professor,MAKI TAISUKE	 particle characteristics, their methods of expression, and the behavior of particles. 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
Target year Ind year students or above Number of creation Days and periods Wed.1 Class style Lecture	dits 2 Year/semesters 2021/Second semester	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.
purifying substances, as well as mechanical unit opera particulate matter (powders), beginning from an overv	f various operations (unit operations), and this course d-based mass transfer unit operations for separating and tions related to the production and processing of riew of their basic phenomena and operating principles na and their quantitative expression methods. Students	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
[Course objectives] Cultivate an understanding of the concepts of mass ba control by studying examples of typical separation ope process control in chemical processes. In addition, stu- chemical processes.		[Evaluation methods and policy] Course grades will be based on the results of regular examinations and reports assigned as needed to improvunderstanding. [Textbooks] [橋本、荻野『現代化学工学』(産業図書) ISBN:4782826095
[Course schedule and contents]		
Basics of substance separation and purification, 2 so These sessions will explain the principles and methods in chemical processes, as well as the fundamentals of i 2. Gas absorption, 2 sessions Students will learn the concept of the "differential co equilibrium of gas dissolution in liquids, the diffusion and design methods for gas absorption devices. 3. Distillation, 3 sessions	s of separation and purification of important substances molecular diffusion and mass transfer. ontact method", through lectures discussing phenomenon in the liquid phase, gas absorption rates,	[References, etc.] (Reference books) 龟井編『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.])
method for a continuous rectification stage column, w		Please visit KULASIS to find out about office hours.

Course number	U-ENG27 2	7401 LJ61	U-ENG	27 27401	LJ76				
Course title (and course title in English)	i体力学 nental Fluid Mec	hanics	n	structor's ame, job ti nd departn f affiliation	nent	Graduate School of Engineering Associate Professor, TANIGUCHI TAKAS			
Target year 2nd	year students or above	Number o	of credit	5 2	Year	/semesters	2021/Second seme	1/Second semester	
Days and periods Tue.			Lecture			Language of instruction	Japanese		
[Overview and p	-								
Lecture on fundame	entals of fluid dyn	namics need	led for Cl	nemical E	nginee	ring			
[Course objectiv	ves]								
Goal of this class is	to understand th	e fundamen	tal pricip	als in flui	d dyna	mics.			
[Course schedul	le and content	s]							
Introduction to fluic 0. Example of flo 0.1. flow of ideal fl 0-2. Laminar flow 0-3. Stability of floo 0-4. Turbulent 0-5. Computational 1. Properties of fl 1-1. Viscosity 1-2. Compressibility 1-2. Compressibility 1-3. Laminar and tu 2. Quiescent fluic 2-1. Pressure 2-2. Buoyancy Dynamics of Ideal fl 3. Fundamentals on 3-1. Particles and cc 3-2. One dimension 3-3. Three-dimension 4-1. Mechanics in th 4-2. Equation of con 4-3. Euler's equati 4-6. Streaming func Dynamics of viscou 5. Dynamics of viscou 5. Dynamics of viscou 5-3. Exact soluble p	ws iuid w fluid dynamics uid y rbulent flows flows flows flows flow (Prepar he ideal fluid ntinuity ion of motion leorem tion and potential s fluid, (5-times) ous fluid	ation of Ma		, ,		Zontinue to a	基碳流体 力 孕(ī)↓	.↑_↑	

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 (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.

Course n	umber U-ENG27	7 27402 LJ61 U	-ENG27 27402	LJ76	
Course title (and course title in English)	■ 化学工学計算機演習 Computer Programming		Instructor's name, job ti and departn of affiliation	le, Professor,KA Graduate Sci	hool of Engineering AWASE MOTOAKI hool of Engineering rer,ASHIDA RIYUUICHI
Target yea	ar Ond waar students or ab	ove Number of c	redits 2	Year/semesters	2021/Second semester
Days and per	w and purpose of th		cture	Language of instruction	Japanese
-	nd practices of fundame	-	r algorithms and	programming usin	g FORTRAN 77 and
Visual Basi	ic for Applications (VE ngineers. FORTRAN 7	BA) for learning b	asic knowledge	and skills of comp	utation required for
IC aurora a	a hia atiwa a 1				
To learn sy	objectives] ntaxes of FORTRAN 7 sic chemical engineerin		to write progra	ms, and how to exe	cute program for
[Course s	schedule and conte	nts]			
1) Introduc		ers and programm	ing languages a		puts, and simple loop, 4) Description of
0					
To write an the trapezoi	5: Practice of computer nd execute 2 or 3 progra idal rule, Newton met	ams solving fundation me	amental problen ethod	ns. e.g. Simple calc	culations, integration by
To write an the trapezo Weeks 68 1) Built-in	5: Practice of computer nd execute 2 or 3 progra	ams solving funda thod, bisection me s and programmin 1 subroutine subpr	amental problen ethod ng II rograms, 2) Data	0	, , , ,
To write an the trapezoi Weeks 68 1) Built-in Interpolatio Weeks 91	5: Practice of computer d execute 2 or 3 progra idal rule, Newton met 8: Computer algorithms functions, function and on, numerical integratio 11: Practice of compute d execute 2 or 3 progra	ams solving funda thod, bisection me s and programmin d subroutine subpr on, 4) Description er algorithms and	amental problen ethod og II ograms, 2) Data of assignments programming II	a format, input from	n and output to file, 3)
To write an the trapezoi Weeks 68 1) Built-in Interpolatio Weeks 91 To write an linear least Week 12: V	5: Practice of computer d execute 2 or 3 progra idal rule, Newton met 8: Computer algorithms functions, function and on, numerical integratio 11: Practice of compute d execute 2 or 3 progra	ams solving funda thod, bisection me s and programmin d subroutine subpron, 4) Description er algorithms and ams solving funda	amental problem ethod gg II of assignments programming II amental chemic:	l format, input fron	n and output to file, 3)
To write an the trapezor Weeks 68 I) Built-in : Interpolatic Weeks 91 To write an linear least Week 12: V Fundament Weeks 13	5: Practice of computer id execute 2 or 3 progra- idal rule, Newton met 3: Computer algorithms functions, function and on, numerical integration 11: Practice of compute ad execute 2 or 3 progra- square VBA programming	ams solving funda thod, bisection me s and programmin s ubroutine subpro- er algorithms and ams solving funda Applications and programming	amental problem ethod or gI or grams, 2) Data of assignments programming II amental chemica some examples	of VBA codes	n and output to file, 3) lems. e.g. Statistics,

Course nur	nber	U-EN	G27 27	403 LJ76	U-EN	G27 27403	LJ61			
	Z応工: Themic	学 I al Reactio	on Engii	neering I	Instructor's name, job t and depart of affiliatio	itle, ment	Graduate School of Engineering Associate Professor,NAKAGAWA HIRO Graduate School of Engineering Professor,KAWASE MOTOAK			
Farget year	2nd y	ear students	or above 1	Number	of cred	lits 2	Yea	r/semesters	2021/Second semeste	
Days and period	s Fri.1		Class	style	Lecture	e		Language of instruction	Japanese	
[Overview a	and pu	urpose o	of the c	ourse]	I					
Homogeneous complex react									eration of reactors,	
[Course ob	jectiv	es]								
	l kineti	c analysis	s of hon						els for design, itions and to be	
[Course sc	hedul	e and co	ontents]						
Complex reac Kinetic analys Nonisotherma	ms,2tin tions,4 sis of re	nes, times, eactions a	nd desi	nisochoric gn and op			2.5tim	25,		
Complex reac Kinetic analys Nonisotherma Itime, Course rec It is required t	ms,2tin etions,4 sis of re al react quiren to learn	nes, times, eactions a ors,4.5tim	nd designes,	gn and op	eration of	of reactors,			c knowledge of	
Complex reac Kinetic analys Nonisotherma ,1time, [Course rea It is required to ordinary diffe	ms,2tin tions,4 sis of react al react quiren to learn rential	nes, times, eactions a ors,4.5tim nents] n Fundamo equations	nd designes, entals of s and ma	gn and op f Chemica atrix.	eration of	of reactors,			c knowledge of	
[Course red	ms,2tin etions,4 sis of react al react quiren to learn rential	nes, times, eactions a ors,4.5tim nents] n Fundame equations ods and	entals o s and ma	gn and op f Chemica atrix.	eration of	of reactors, ss Enginee	ring an	d to have basic	c knowledge of	
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Course num	ber U	-ENG27 3	/404 LJ61							
							tle, nent	Graduate School of Engineering Professor,MATSUBARA SEIJIR Graduate School of Engineering Associate Professor,KURAHASHI TAKU		
Farget year	3rd year stu	dents or above	Number	of credi	its	2	Year	/semesters	2021/Second semester	
Days and periods			s style	Lecture	;		Language of instruction		Japanese	
[Overview a	nd purpo	se of the	course]							
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None										
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Course n	umber U-ENG27 17405 LJ60		未更新	工業化学概論 [工化1] (2)
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,NAKAO YOSHIAKI Institute for Chemical Research Professor,KAJI HIRONORI Graduate School of Engineering Professor,KOGA TSUYOSHI Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,KONDOU TERUYUKI Graduate School of Engineering Professor,KONDOU TERUYUKI Graduate School of Engineering Professor,Gethool of Engineering Professor,GuOME MICHINORI Graduate School of Engineering Professor,GUGNOME MICHINORI Graduate School of Engineering Professor,ABE TAKESHI Graduate School of Engineering Professor,ABE TAKESHI Graduate School of Engineering Professor,ABE TAKESHI Graduate School of Engineering Professor,WATANABE HIROSHI Graduate School of Engineering Professor,WATANABE HIROSHI Graduate School of Engineering Professor,EIRAKU GENJI Graduate School of Engineering Professor,EIRAKU GENJI Graduate School of Engineering Professor,EIRAKU GENJI Graduate School of Engineering Professor,EIRAKU GENJI Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,MAE KAZUHIRO Graduate School of Engineering Professor,MAE KAZUHIRO	Image:
Target yea			ar/semesters 2021/First semester	Lecture 10: High polymer chemistry field: Professor Hiroshi Watanabe: Motion and relaxation of high polymers Lecture 11: Biochemistry field: Professor Yasuo Mori: Life-likeness of matter
			mpagement superior	Lecture 11: Biochemistry field: Professor Yasuo Mori: Elie-likeness of matter Lecture 12: Biochemistry field: Professor Mototsugu Eiraku: Organogenesis technology using stem cell: Lecture 13: Chemical engineering field: Professor Motoaki Kawase, Professor Kenichiro Sotowa, Profe Kazuhiro Mae, Professor Shuji Matsusaka: Quantitative relationship of matter in chemical processes, en balance and global environmental conservation
			Continue to 工業化学概論 [工化1](2)↓ ↓ ↓	

工業化学概論[工化1](3)	Course	number	U-ENG2	27 17405 LJ6	0				未更新
Action Formation Contract of the second	Course titl (and cours title in English)	e e 工業化当	ど概論〔⊥			Instructor's name, job til and departm of affiliation	Pr In: Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Gi Pr Pr Pr Pr Pr Pr Pr Pr Pr Pr Pr Pr Pr	ofessor,NA stitute for C ofessor,KA aduate Sch ofessor,KC aduate Sch ofessor,MI aduate Sch ofessor,MI aduate Sch ofessor,KC aduate Sch ofessor,SU aduate Sch ofessor,SU aduate Sch ofessor,SU aduate Sch ofessor,MI aduate Sch ofessor,MI aduate Sch ofessor,MI aduate Sch ofessor,AB	ool of Engineering KAO YOSHIAKI Themical Research JI HIRONORI ool of Engineering GA TSUYOSHI ool of Engineering E RYUU ool of Engineering TSUBARA SEJI OOI of Engineering NDOU TERUYUJ ool of Engineering GINOME MICHIN DOUT ERUYUJ ool of Engineering GSHI TOMOKI Themical Research MCATA YASUJIR ool of Engineering SUKA KOJI Gilobal Environmental '
(Reference books) ters; materials are introduced in lectures when needed. tudy outside of class (preparation and review)] idents are given appropriate instructions during teaching sessions, and are required to review printouts and er materials distributed during these sessions. Other information (office hours, etc.)) idents are required to submit reports when necessary. The order of items covered in lectures is subject to me.							Pr In: Pr Ins Pr Gi Pr Gi Pr	ofessor,TA stitute for C ofessor,WA raduate Sch ofessor,MC titute for Fron ofessor,EII raduate Sch ofessor,KA raduate Sch ofessor,SO	NAKA KAZUO hemical Research ITANABE HIROS tool of Engineering DRI YASUO tier Life and Medical Sc AKU GENJI tool of Engineering WASE MOTOAK tool of Engineering TOWA KENICHII
Please visit KULASIS to find out about office hours.	Target ve			ibova Numbe	r of grad	lite 2	Pr Gi Pr	ofessor,MA aduate Sch	ool of Engineering AE KAZUHIRO ool of Engineering ATSUSAKA SHUJ
				100va Numbe	or creu		Tean/se	mesters	2021/First semest

工業化学概論 [工化2] (2)
[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, I time, 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)
[Study outside of class (preparation and review)]
(Other information (office hours, etc.)) *Please visit KULASIS to find out about office hours.
Trease visit COLASIS to find out about office nours.

· · · · · · · · ·	二業化学概論〔 troduction to Ir		nemistry	r a	Instructor's name, job ti and departn and departn of affiliation	tle, nent	Professor, MI Graduate Sci Professor, AL Graduate Sci Professor, AL Graduate Sci Professor, SC Graduate Sci Professor, CG Graduate Sci Professor, CG Graduate Sci Professor, AL Graduate Sci Professor, AL Graduate Sci Professor, AL Graduate Sci Professor, AL Graduate Sci Professor, AL Graduate Sci Professor, AL Professor, AL Professor, AL Professor, AL Professor, AL Professor, AL Professor, BL Graduate Sci Professor, GL Graduate Sci Professor, AL Graduate Sci Professor, AL	tool of Engineering NTSUBARA SEIJIROU tool of Engineering NDOU TERUYUKI tool of Engineering GINOME MICHINORI OSHI TOMOKI Chemical Research JRATA YASUJIROU tool of Engineering BE TAKESHI tool of Engineering SUKA KOJI of Global Environmental Studies NAKA KAZUO Chemical Research ATANABE HIROSHI tool of Engineering
Farget year	1st year students	or above Nu	nber of c	credit	ts 2	Year	/semesters	2021/First semester
Days and period	s Wed.1	Class sty	/le Le	cture			Language of instruction	Japanese

工業化学概論 [工化3] (2)

[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 signaturebased 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, Times, Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance. Presentation, I time, 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)

[Study outside of class (preparation and review)]

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

_____Continue to 工業化学概論『工化3』(3)↓↓↓

	未更新
工業化学概論[工化3](3)	大史制 Course number U-ENG27 17405 LJ60
	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,NAKAO YOSHIAKI Institute for Chemical Research Professor,NAKAO YOSHIAKI Institute School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ADONDME MICHNORI Graduate School of Engineering Professor,ABE RYUU Graduate School of Engineering Professor,ADOSHI TOMOKI Institute for Chemical Research Professor,AUTAYASUJIROU Graduate School of Engineering Professor,AUTAYASUJIROU Graduate School of Engineering Professor,GISUKA KOJI Graduate School of Engineering Professor,FUAYAU GENI Graduate School of Engineering Professor,FUAYAU GENI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Engineering Professor,KAWASE MUJI
	Target year Ist year students or above Number of credits 2 Year/semesters 2021/First semester
	Days and periods Wed.1 Class style Lecture Laquage distriction Japanese
	Continue to 工案化学概論 [工化4] [2]↓↓↓
工業化学概論[工化4](2) [Overview and purpose of the course]	工業化学概論[工化4](3)
[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.	

traftic by machine learning algorithms and public dataset for benchmarking intrusion detection perform Presentation, ltime,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)

[Study outside of class (preparation and review)]

(Other information (office hours, etc.))

*Please visit KULASIS to find out about office hours.

_____Continue to 工氣化學概論 [工代4] (3)↓↓↓

大更新 Course number U-ENG27 27406 LJ60	Course number U-ENG27 27407 EJ61
Course title (and course) G分子化学序論 Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,AKIYOSHI KAZUNARI	Course title (and course title in English) Chem-E-Car設計・実験 Chemical-E-Car Design and Experiment of affiliation of affiliation
Target year Ind year students or above Number of credits 2 Year/semesters 2021/First semester	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second semesters
Days and periods Wed.2 Class style Lecture Language distuition Japanese [Overview and purpose of the course]	Days and periods Fri.4,5 Class style Practical training Language disturbing Japanese [Overview and purpose of the course]
[Course objectives]	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。走 行コンテストのときには所要電力の測定も行い、省エネ走行の評価も行う。
[Course schedule and contents] 1 times, 5 times,	[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、熟電効果、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
3 times, 4 times, 1 times,	養う。 [Course schedule and contents]
[Course requirements] None	 (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の設計方針の討論 (3) 設計方針討論【1週】: 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
[Evaluation methods and policy]	 (4) 上中美语【1週】: Chem-E-Carb/案中に必要な上中政府や上中級徴の使用力法の説明、美音 (5) Chem-E-Car製作、試運転【5週】: 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】: 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
[Textbooks]	[Course requirements] None
[References, etc.]	[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。
(Reference books)	Cnem-E-Carの止打吐肥(コンフスト結末)、成本報告云にわりる完衣、レホートにより計画9 る。
[Study outside of class (preparation and review)]	
(Other information (office hours, etc.)) Please visit KULASIS to find out about office hours.	Continue to Chem-E-Car設計・実験(2)↓↓↓
	Continue to Cheni-⊂-Catazai * 天歌(2) ↓ ↓ ↓
Chem-E-Car設計・実験(2)	Course number Graduate School of Engineering Professor,SAKKA TETSUO
[Textbooks] 数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)]	Course title (and course title in English)
授業中に指示する (Other information (office hours, etc.))	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second semesters
*Please visit KULASIS to find out about office hours.	Days and periods Mon.2 Class style Lecture Languar institution Japanese [Overview are purpose of the course] Japanese Japanese 無機化学1では、様々なブレンステッド酸・塩基、ルイスの酸・塩基を解説する。次に、酸化と還 元について、電気化学を中心に概認する。さらに、分子の形を理解する上で重要な群論の概念について解説し、分子の形と分子の反応性や化学的性質との関連について述べる。さらに、d-ブロック 化合物の錯体について述べる。
	[Course objectives] 酸・塩基、酸化還元、対称性、配位化合物について理解し、3学年開講の無機化学II、4学年開講 の電気化学に繋げる。
	[Course schedule and contents] 酸と塩基(4章)4回 酸および塩基に属する化学種について講義する。まず、Bronstedの酸・塩基の定義を述べ、酸の強 さを定量的に表現するための酸解離定数や、Bronsted酸性度の周期性について解説する。次にLewis による酸塩基の定義を講義し、Peasonの硬い酸・軟らかい酸の概念を講義する。最後に、酸・塩基 としての溶媒の性質を定量的に表現するための溶媒パラメーターを解説する。
	酸化と還元(5章),4回 一つの物質からもう一つの物質へ電子が移動して酸化と還元が生じる。この二つの過程をまとめて 酸化還元反応という。この反応に関する熱力学的効果と速度論的効果について述べ、この両者が重 要であることを示す。さらに、酸化還元反応の解析に用いられる電気化学的に重要な因子rdquo標 準(電極)電位rdquoについて解説する。
	分子の対称性(7章),4回 分子の形を対称性の観点から捉え、その対称性を示す重要な概念である群論について述べる。また 分子の対称性に関する考察から分子が有する物理的な性質や分光学的な性質について予測できるこ とを解説する。さらに、分子軌道の組み立てや、電子構造の考察、分子振動の議論を単純化する上 で分子の対称性が重要となることを示す。
	配位化合物 (8章),2回 Continue to 無機停口(機化学) 江(1· 工(3) (2)↓

無機化学 I (先端化学) [工化1・工化3] (2)	無機化学 (先端化学) [工化1・工化3] (3)
Lewisの酸・塩基およびそれらの組合わせである錯体の概念を用いてd-ブロック化合物の幾何学的な 構造について概説する。 学習到達度の確認1回、レポート問題に対する解答および解説を行い、学習到達度を確認する。	(3) Details of practical classes delivered based on instructors' practical work experience 産業技術総合研究所において、基礎的な立場からのみならず、企業との共同研究など実用化に近い 立場において無機化学関連の研究を実施した経験を活かした講義を実施する。
[Course requirements] 基礎無機化学を履修していることを前提に講義を進める。	
[Evaluation methods and policy] 定期試験の成績が主であるが、これに平常点を加味して総合的に判断して評価する。	
[Textbooks] 「シュライパー・アトキンス無機化学(上)第6版」 M.Weller, T.Overton, J.Rourke, F.Armstrong 著 田中 勝久、高橋 雅英、安部 武志、平尾 一之、北川 進訳 東京化学同人 (2016) ISBN 9784807908981	
[References, etc.]	
(Reference books) 第1回講義時に補足説明資料を配布する。	
[Study outside of class (preparation and review)] 授業の前に該当の章を通読しておくこと。その週の講義に該当する問題を適宜選んで宿題として課 し、毎週提出させる。	
(Other information (office hours, etc.)) 受講生を2クラスに分け、クラス毎に定められた教員により同時間帯に授業が行われる。	
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。 注意:「無機化学 I (工業基礎化学)」を、すでに単位修得した学生が「無機化学化学 I (先端化 学)」を履修し単位修得した場合、増加単位となる。	
*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 独立行政法人産業技術総合研究所 4年	
Continue to 無機化学/(先端化学)(工化1・工化3)(3)↓↓↓	

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Course num	ber						
Course title (and course 無	機化学 I (先端	化学) [工化2 ry I (Advanced C	・工化4] na Chemistry) an	structor's me, job tit d departm affiliation	I I I I I I I I I I I I I I I I I I I	Professor,SA Institute of A Professor,NC Graduate ScH Graduate ScH Graduate ScH Traduate ScH Traduate ScH Traduate ScH Traduate ScH Graduate ScH Graduate ScH	tool of Engineering KKA TETSUO dvanced Energy HIRA TOSHIYUKI tool of Engineering ETAKESHI tool of Engineering cate Poisser,HOSUAWA SABUROU tool of Engineering BE RYUU tool of Engineering Sergy AVACKI KOUHEN
Farget year	2nd year students	or above Numbe	r of credits	2	Year/s	semesters	2021/Second semester
Days and periods	Mon.2	Class style	Lecture			Language of instruction	Japanese
酸・塩基、酸 の電気化学に		性、配位化合	物についてヨ	里解し、	3学年	- 開講の無機	後化学II、4学年開講
 ・ ・ ・ ・ は は よ び 塩 基 ご 量 塩 し こ こ<th>表現するため の定義を講義 の性質を定量 (5章),4回 らもう一つの</th><th>・ 種について講 の酸解離定数 し、Peasonのf 的に表現する 物質へ電子が</th><th>や、Bronstee 更い酸・軟 ための溶媒 移動して酸</th><th> ・ ・ ・</th><th>の周期 の概念 ターを が生じ</th><th>性について :を講義する :解説する。 :る。この二</th><th>定義を述べ、酸の強 解説する。次にLewis 。最後に、酸・塩基 二つの過程をまとめて 述べ、この両者が重</th>	表現するため の定義を講義 の性質を定量 (5章),4回 らもう一つの	・ 種について講 の酸解離定数 し、Peasonのf 的に表現する 物質へ電子が	や、Bronstee 更い酸・軟 ための溶媒 移動して酸	 ・ ・ ・	の周期 の概念 ターを が生じ	性について :を講義する :解説する。 :る。この二	定義を述べ、酸の強 解説する。次にLewis 。最後に、酸・塩基 二つの過程をまとめて 述べ、この両者が重
要であること 準(電極)電 分子の対称性 分子の形を対 分子の対称性	を示す。さら 位rdquoについ (7章),4回 称性の観点か に関する考察	に、酸化還元 いて解説する。 ら捉え、その から分子が有	反応の解析し 対称性を示す する物理的が	こ用いら す重要な な性質や	れる電 概念で	気化学的に ある群論に のな性質に	□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
で分子の対称 配位化合物	性が重要とな	ることを示す					

無機化学 | (先端化学) [工化2・工化4] (2)

Lewisの酸・塩基およびそれらの組合わせである錯体の概念を用いてよブロック化合物の幾何学的な 構造について概説する。

学習到達度の確認,1回 レポート問題に対する解答および解説を行い、学習到達度を確認する。

[Course requirements] 基礎無機化学を履修していることを前提に講義を進める。

[Evaluation methods and policy]

定期試験の成績が主であるが、これに平常点を加味して総合的に判断して評価する。

[Textbooks] 「シュライバー・アトキンス無機化学(上)第6版」 M.Weller、T.Overton、J.Rourke、F.Armstrong 著 田中 勝久、高橋 雅英、安部 武志、平尾 一之、北川 進訳 東京化学同人 (2016) ISBN 9784807908981

[References, etc.]

(Reference books) 第1回講義時に補足説明資料を配布する。

[Study outside of class (preparation and review)] 授業の前に該当の章を通読しておくこと。その週の講義に該当する問題を適宜選んで宿題として課 し、毎週提出させる。

(Other information (office hours, etc.)) 受講生を2クラスに分け、クラス毎に定められた教員により同時間帯に授業が行われる。 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。

注意:「無機化学 I (工業基礎化学)」を、すでに単位修得した学生が「無機化学 I (先端化学)」 を履修し単位修得した場合、増加単位となる。

*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

_____ Continue to 無機化字 [〔/先罷化字〕〔1.1/2・工化4〕[3] ↓↓↓

無機化学 (先端化学) [工化2・工化4] (3)	Course number
独立行政法人産業技術総合研究所 4年	Graduate School of Engineering Professor, SAKKA TETSUO Institute of Advanced Energy
(3) Details of practical classes delivered based on instructors' practical work experience 産業技術総合研究所において、基礎的な立場からのみならず、企業との共同研究など実用化に近い 立場において無機化学関連の研究を実施した経験を活かした講義を実施する。	Course title (and course title in English) 分析化学 I (先端化学) [工化1・工化3] Instructor's name, job title, and department of affiliation Instructor's professor,NOHIRA TOSHIYUKI and department of affiliation Professor,NOHIRA TOSHIYUKI Associate Professor,ADE TAKESHI Graduate School of Engineering Professor,ADE TAKESHI Graduate School of Engineering Associate Professor,NISHI NAOYA
	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second semester
	Days and periods Tue.2 Class style Lecture Language distinction Japanese [Overview and purpose of the course]
	分析化学の入門として、また、化学一般の基礎として重要な、溶液中の化学平衡(酸塩基、錯形成 沈殿、酸化還元)の考え方を講述する。問題を解く力を身につけるための演習を行う。 [Course objectives]
	溶液中の化学平衡の考え方を身につけ、問題を解く力を身につけるにとどまらず、それが、他の化学・科学にどのように関連しているか、また、現代の諸問題にどうかかわっているかを意識できるようになることを目標とする。
	[Course schedule and contents] 化学平衡概説,2回
	われわれがコントロールできる、あるいは正確に知りうる初期条件(量り取った試薬の量、測容器 の体積など)から、溶液内における平衡状態(化学種の濃度や酸化還元状態)を求める時の考え方 は、どの化学平衡でも共通である。その基本を解説する。
	酸塩基平衡,5回 はじめに、溶液のpHの計算法を解説する。種々の近似的な計算法の基礎にある論理的な考え方、 系統立てた理解に重点を置く。次に、滴定曲線の形と意味、緩衝作用の考え方、多段階の酸塩基平 衡が関与するより複雑な場合について詳しく述べる。
	沈殿生成,1回 沈殿平衡の基本(溶解度積や共通イオン効果)について概説した後、酸塩基平衡やイオン対生成平 衡などの他の化学平衡が共存する場合の取り扱い方を解説する。
	錯生成平衡,2回 錯生成反応の概説の後、代表的なキレート剤であるEDTAを例に取り上げてキレート滴定時にお ける錯生成反応について解説する。pHや補助錯化剤の効果も含めて定量的なキレート滴定の取扱を 講述する。
	酸化還元平衡.4回 酸化還元平衡を理解するための基礎となる電気化学、特に電極電位やネルンスト式について解説す る。さらに、酸化還元滴定中での電極電位と酸化還元平衡の関係について講述する。
	Cominue to 分析化字 「 (先端化字) [工化1・工化3] (2) [↓
学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None	Course number Course title (and course title in English) 分析化学 I (先端化学) [工仕2・工作4] Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor, SAKKA TETSUO Institute of Advanced Energy Professor, ABKA TOSHIYUKI Institute of Advanced Energy Professor, ABE TAKESHI Graduate School of Engineering Professor, ABE TAKESHI Graduate School of Engineering Associate Professor, BE TAKESHI BE TAKESHI Graduate School of Engineering Associate Professor, BE TAKESHI Graduate School of Engineering Associate Professor, BE TAKESHI Associate Pro
学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。 [Textbooks]	Course title (and course) 分析化学 I (先端化学) [工化2・工化4] Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,SAKA TETSUO title in English) Analytical Chemistry I (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,ASI VUUCH Graduate School of Engineering Professor,ASE TAKESHI Graduate School of Engineering Associate Professor,NISHI NAOY/
None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。	Course title (and course title in English) 分析化学 I (先端化学) [工化2・工化4] Instructor's name, job title, analytical Chemistry I (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor, SAKKA TETSUO Professor, NOHIRA TOSHIYUKI Associate Professor, NCHUVUCH Graduate School of Engineering Professor, NCHUVUCH Graduat
学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。 [Textbooks] Daniel C. Harris 『Quantitative Chemical Analysis, 10th ed.』(Freeman (2020)) [References, etc.]	Course title (and course title in English) 分析化学 I (先端化学) [工化2・工化4] Instructor's name, job title, analytical Chemistry I (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor, SAKA TETSUO Institute of Advanced Energy Professor, SAKA TETSUO Professor, SAKA TETSUO Saconate Professor, SAKA Associate Professor, SAKE Associate Professor, SAKE Associate Professor, SAKE Associate Professor, SAKE Associate Professor, SAKE Professor, SAKE Associate Professor, SAKE Target year Target year Ind year students or above Tue.2 Number of credits 2 Year/semesters 2021/Second semester Days and periods Tue.2 Class style Lecture Lecture Lequipy distudie [Overview and purpose of the course] Used Saconate Professor, SAKE Japanese
学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。 [Textbooks] Daniel C. Harris 『Quantitative Chemical Analysis, 10th ed.』(Freeman (2020)) [Reference books) デイ・アンダーウッド『定量分析化学(改訂版)』(培風館、1982年) ISBN:4563041513 クリスチャン『分析化学1(原書第7版)』(丸善、2016年) ISBN:9784621301098	Course title (and course) 分析化学 I (先端化学) [エ化2・エ化4] Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,SAKA TETSUO Institute of Advanced Energy Professor,SNHRA TOSHIYUKI Institute of Inlegrade Radiation and Nuclear Scient Sascoiate Professor,AN UUICH Graduate School of Engineering Professor,AN E TAKESHI Graduate School of Engineering Professor,AN E TAK
学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。 [Textbooks] Daniel C. Harris 『Quantitative Chemical Analysis, 10th ed.』(Freeman (2020)) [Reference books] デイ・アンダーウッド『定量分析化学(改訂版)』(培風館、1982年)ISBN:4563041513 クリスチャン。『分析化学1(原書第77版)』(丸善、2016年)ISBN:9784621301098 岡田、垣内、前田『分析化学の基礎』(化学同人、2012)ISBN:9784759814651 [Study outside of class (preparation and review)]	Course title (and course title in English) 分析化学 I (先端化学) [工化2・工化4] Analytical Chemistry I (Advanced Chemistry) Instructor's name, job title, and dopartment of affiliation Graduate School of Engineering Professor, NACH AT COSHIYUKI Associate Professor, NCHIRA TOSHIYUKI Associate Professor, NCHIRA TOSHIYUKI Professor, NCHIRA TOSHIYUKI Professor, NCHIRA TOSHIYUKI Professor, NCHIRA TOSHIYUKI Associate Professor, NCHIRA TOSHIYUKI Professor, NCHIRA Japanese IOverview and purpose of the course] Days and periods NC WC 20, Drie LC to, z.c. (L'2' - @O'AS, Z'AS', Z
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学習到達度の確認,1回 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。 [Course requirements] None [Evaluation methods and policy] 評価は、定期試験(筆記)の成績による。 [Textbooks] Daniel C. Harris 『Quantitative Chemical Analysis, 10th ed.』 (Freeman (2020)) [Reference books] デイ・アンダーウッド『定量分析化学(改訂版)』(培風館、1982年) ISBN:4563041513 クリスチャン『分析化学1 (原書第7版)』 (丸善、2016年) ISBN:9784621301098 岡田、垣内、前田『分析化学の基礎』 (化学同人、2012) ISBN:9784759814651 [Study outside of class (preparation and review)] 講義内容に関する演習問題を宿題として課す。 (Other information (office hours, etc.))	Course title (and course) title in English) Orff(L学1 (先端(ビ学) [T.(L2・T.(L4) Analytical Chemistry I (Advanced Chemistry)) Instructor's name, job titl. and department of affiliation Graduate School of Engineering Professor, SAKKA TETSUO Institute of Advanced Energy Professor, NOHRA TOSHIYUKI Indiate for Integrate Mataiano and Naedar Scien Associate Professor, OKI YUUICH Graduate School of Engineering Professor, ABE TAKESHI Graduate School of Engineering Professor, NISH TAKESHI Graduate Schol of Engineering Professor, NISH TAKESHI Graduat

分析化学1(先端化学) [工化2・工化4](2)

学習到達度の確認,1回 房類レーマヨー 宿題として課した演習問題に対する解説を行い、学習到達度を確認する。

[Course requirements]

[Evaluation methods and policy]

評価は、定期試験(筆記)の成績による。

[Textbooks]

Daniel C. Harris 『Quantitative Chemical Analysis, 10th ed.』 (Freeman (2020)) ISBN:4563041513

[References, etc.] (Reference books)

(Reference books) デイ・アンダーウッド 『定量分析化学 (改訂版) 』(培風館、1982年)ISBN:4563041513 クリスチャン『分析化学1(原書第7版)』(丸善、2016年)ISBN:9784621301098 岡田、垣内、前田『分析化学の基礎』(化学同人、2012年)ISBN:9784759814651

[Study outside of class (preparation and review)] 講義内容に関する演習問題を宿題として課す

(Other information (office hours, etc.))注意:「分析化学 I (工業基礎化学)」を、3 を履修し単位修得した場合、増加単位となる。 すでに単位修得した学生が「分析化学 I (先端化学)

*Please visit KULASIS to find out about office hours

Course number Graduate School of Engineering Professor,OOE KOUICHI Graduate School of Engineering Associate Professor,MIURA TOMOYA Course title Instructor's (and course 有機化学 I (先端化学) 「工化1・工化3] name, job title, and department of affiliation Organic Chemistry I (Advanced Chemistry English) institute for Chemical Research Professor, NAKAMURA MASAHARU 2nd year students or above Number of credits 2 Year/semesters 2021/Second semester Target year Days and periods Mon.1 Class style Lecture Language of instruction Japanese [Overview and purpose of the course] Organic Chemistry I-IV are taught over two years (from the second half of sophomore year to the first half of senior year) as subjects that systematically instill students with the basics of organic chemistry they will need to know in order to work as researchers and engineers in all fields related to chemistry in the industrial, academic, and public sectors. Among these subjects, Organic Chemistry I allows students to understand ideas of acids and bases, as well as concepts of delocalization and conjugation of electronic states in compounds and intermediates, while also teaching them about reactions involving carbonyl groups from the standpoint of molecular orbital theory. In addition, students are taught how to determine the structure of organic ompounds by making full use of various spectral methods. [Course objectives] The goal is to understand organic reactions in a unified manner by considering mechanical similarities, rather than through mechanical memorization. [Course schedule and contents] Structure of molecules and method of expressing organic reactions (Chapter 4 and Chapter 5), 1 session Atomic orbitals and molecular orbitals are explained to students to provide a deeper understanding of the relationship between the shape of organic molecules and electronic structures. In addition, students learn to depict the movement of electrons in organic reactions using curved arrows. Nucleophilic addition reactions to carbonyl groups (Chapter 6), 2 sessions Students are given an overview of reaction modes between carbonyl groups and nucleophiles. Delocalization and conjugation (Chapter 7), 2 sessions The concepts of "delocalization and conjugation," which are important for understanding differences in reactivity and physical properties of organic molecules, are explained using molecular orbital theory. In ddition, aromaticity is explained. Acidity and basicity (Chapter 8), 2 sessions Students develop an understanding of the structural characteristics of compounds related to acidity and basicity, and learn how to calculate and use pH and pKa. In addition, equilibrium theory and changes in the electronic structure of compounds in proton transfer reactions are explained. During the session, an xamination is conducted to confirm how much students have learned to date. Organometallic reagents for carbon-carbon bond formation (Chapter 9), 1 session The method for preparing organometallic compounds and examples of carbon-carbon bond forming reactions The method for preparing organomicianic composition that use organometallic compounds are explained. Continue to 有概[[字] (法能学) [工化1-工化3] [4]]]

有機化学 | (先端化学) [工化1・工化3](2)

Nucleophilic substitution reactions on the carbon in carbonyl groups (Chapter 10), 2 sessions By showing examples of substitution reactions that occur on the carbon in carbonyl groups, students are able to gain an understanding about the reactivity of carbonyl compounds based on reaction mechanisms that go through tetrahedral intermediates and the properties of nucleophiles and leaving groups. Using such examples also allows synthesis reactions that involve carbonyl compounds to be explained in a systematic manner.

tion reactions at C=O, following loss of carbonyl oxygen (Chapter 11), 2 ses The mechanisms behind the formation of acetals, imines, and alkenes from carbonyl compounds and their applications in synthetic chemistry are explained.

How to determine the structure of organic compounds (Chapter 3 and Chapter 13), 2 sessions Students are explained the principles and characteristics of infrared spectroscopy and nuclear magnetic resonance spectroscopy, and are taught for determining the structure of organic compounds by reading arious spectra.

Feedback lecture, 1 session

The fourteen lectures and examination contents are explained to students to improve their degree of learning (details are given during the lecture or on KULASIS). [All professors]

[Course requirements]

Jone

[Evaluation methods and policy]

[Evaluation method] Marks from (mid-term and end-of-term) examinations (90%); evaluation of performance in teaching sessions (10%)

Perforn ance in teaching sessions is evaluated based on participation in sessions and the assessment of reports assigned in each teaching session.

[Evaluation policy] Students must obtain a total of at least 60 (out of 100 marks) from the results of their (mid-term and end-ofterm) examinations and their performance in teaching sessions.

60 marks or more: Pass 59 marks or less: Fail

[Textbooks]

J. Clayton, N. Greeves, and S. Warren 『Organic Chemistry, 2nd Ed.』 (Oxford University Press) ISBN: 9780199270293

[References, etc.]

(Reference books) McMurry, J. (translated by Shibasaki, M., Iwasawa, N., Owada, T., Mashino, T.,) McMurry Organic Chemistry (Tokyo Kagaku Dojin, 2009) ISBN:9784807906918

_____Continue to 有機化学「 (先端化学) 「エ化1・エ化3」 (3) ↓↓

有機化学 I (先端化学) [工化1・工化3](3)

[Study outside of class (preparation and review)]

Students should briefly glance over the handouts and textbook, and prepare for the contents of each unit before attending any lecture. In addition, students will actively work on report assignments given in each teaching session, while deepening their understanding of the contents of each unit. It would also be advisable for students to devote twice the amount of time spent in teaching session to review the material and prepare for the next session.

(Other information (office hours, etc.))

Students are divided into two classes and each class is assigned a professor who will conduct teaching essions in the same time slot.

For details on office hours, please check KULASIS

Note: If a student who has already completed "Organic Chemistry I (Basic Industrial Chemistry)" takes Organic Chemistry I (Advanced Chemistry)" and earns credit, these will be treated as additional credits.

Course nu	Imber							7 種	横化学 (先端
Course title	有機化学 I (先端化学 Organic Chemistry I (A		工化4] nar emistry) and	tructor's ne, job t I departr affiliatior	s title, ment n	Professor,OC Graduate Scl Associate Pro Institute for	hool of Engineering DE KOUICHI hool of Engineering fessor,MIURA TOMOY Chemical Research KAMURA MASAHAR	A E	Nucleophilic su 3y showing ex o gain an unde
Target yea	r 2nd year students or abo	we Number	of credits	2		/semesters	2021/Second semeste	- u	hrough tetrahe Ilso allows syn
Days and perio	ods Mon.1 Cla	ss style	Lecture			Language of instruction	Japanese		Nucleophilic su
[Overview	and purpose of th	e course]							The mechanisn pplications in
senior year) to know in o academic, ar of acids and and intermed molecular or	as subjects that system rder to work as resear ad public sectors. Amo bases, as well as conc	natically inst chers and en- ong these sub- cepts of deloc hing them ab on, students a	ill students v gineers in al ojects, Orgar calization an out reaction are taught ho	with the l fields nic Cher d conju s involv ow to de	e basics related mistry I gation o ving car	of organic cl to chemistry allows stude of electronic bonyl groups	ents to understand ideas states in compounds from the standpoint o	l F s ru f F	How to determ Students are ex esonance spec various spectra Geedback lectu The fourteen le
10									details are give
			unified ma	nner by	consid	ering mechar	nical similarities, rather		[Course requies None
[Course s	chedule and conte	nts]						1 h	[Evaluation
Atomic orbit relationship depict the m Nucleophilic	molecules and method tals and molecular orb between the shape of ovement of electrons is addition reactions to given an overview of	vitals are expl organic mole in organic rea carbonyl gro	lained to stu ecules and el actions using oups (Chapte	dents to ectronic g curveo er 6), 2 s	o provid c structi d arrow sessions	le a deeper ur ures. In addit 's. s	nderstanding of the ion, students learn to	[] M P a [] S	Evaluation me Marks from (m 10%) Performance in ssigned in eac Evaluation pol Students must of erm) examinat
The concept reactivity an	on and conjugation (C s of "delocalization a d physical properties of maticity is explained.	and conjugation of organic metalog	ion," which					65	0 marks or mo 9 marks or les
Acidity and Students dev basicity, and electronic st	basicity (Chapter 8), 2 relop an understanding learn how to calculat ructure of compounds	e sessions g of the struc e and use pH in proton tra	l and pKa. Ir insfer reactio	n additio	on, equi explain	ilibrium theo ed. During th	ry and changes in the		Clayden, J., Gr SBN:9780199
examination	is conducted to confi	irm how muc	h students h	ave lea	rned to	date.			[References
The method	llic reagents for carbo for preparing organon nometallic compound	netallic comp	oounds and e				bond forming reactions		(Referenc AcMurry, J. (t Chemistry] (
					C	ontinue to 有機化学	(先端化学) [エ化2・エ化4] (2)↓↓	4	
有機化学丨(券	端化学)[工化2・工化4] (3)						ן ב	Course num
	tside of class (prep		d review)1					(t	Course title (and course // title in Ma
Loundy ou	and of class (high	manon di	~ 10 A 10 AN)]						English)

Students should briefly glance over the handouts and textbook, and prepare for the contents of each unit

before attending any lecture. In addition, students will actively work on report assignments given in each teaching session, while deepening their understanding of the contents of each unit. It would also be advisable for students to devote twice the amount of time spent in teaching session to review the material and prepare for the next session.

(Other information (office hours, etc.))

Students are divided into two classes and each class is assigned a professor who will conduct teaching sessions in the same time slot.

* For details on office hours, please check KULASIS.

Note: If a student who has already completed "Organic Chemistry I (Basic Industrial Chemistry)" takes ' Organic Chemistry I (Advanced Chemistry)" and earns credit, these will be treated as additional credits.

*Please visit KULASIS to find out about office hours.

(学) [工化2・工化4] (2)

bstitution reactions on the carbon in carbonyl groups (Chapter 10), 2 sessions mples of substitution reactions that occur on the carbon in carbonyl groups, students are able standing about the reactivity of carbonyl compounds based on reaction mechanisms that go tral intermediates and the properties of nucleophiles and leaving groups. Using such examples hesis reactions that involve carbonyl compounds to be explained in a systematic manner.

stitution reactions at C=O, following loss of carbonyl oxygen (Chapter 11), 2 sessions s behind the formation of acetals, imines, and alkenes from carbonyl compounds and their ynthetic chemistry are explained.

he the structure of organic compounds (Chapter 3 and Chapter 13), 2 sessions plained the principles and characteristics of infrared spectroscopy and nuclear magnetic roscopy, and are taught for determining the structure of organic compounds by reading

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tures and examination contents are explained to students to improve their degree of learning n during the lecture or on KULASIS). [All professors]

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d-term and end-of-term) examinations (90%); evaluation of performance in teaching sessions

eaching sessions is evaluated based on participation in sessions and the assessment of reports teaching session.

bey a construction of the re: Pass

Fail

eves, N., Warren S. 『Organic Chemistry, 2nd Ed.』 (Oxford University Press, 2012) 270293

etc.]

books) unslated by Shibasaki, M., Iwasawa, N., Owada, T., Mashino, T.,) McMurry Organic okyo Kagaku Dojin) ISBN:9784807906918

_____ Continue to 有機化字 □ (先端化字) [I(12・II(4) [3)]]

Course title (and course title in English)		学I (先端 al Method in (Chemistry)	Instructo name, jol and depa of affiliat	title, rtment	Associate Pr Center for the Promotion	hool of Engineering rofessor,ITOU AKIHIRO n of Interdisciplinary Education and Researc ssociate Professor,FUKUDA RYOICH
Target year	or above I	Number	of cred	its 2	Yea	r/semesters	2021/Second semester		
Days and perio				style	Lectur	e		Language of instruction	Japanese
[Overview 化学を学修 とともに演 [Course ol	する上 習を行・	で必要な数 う。			、ての線	型代数・	複素解	析の基本的	事項について講義する
目の学習の	際に必要	要となる数	数学的	記述を容					ど数学Ⅱなどの専門科
[Course so [行列と線形	代数の	技法 (担)	当:伊菔	[*)]			7.00		
- [行列と線形 物理化学に	沢数の 現れる (算子)の 列 [2回]	技法 (担) 諸問題は1)具体的な	<u>当:</u> 伊萠 しばし	<u>-</u> [6)] .ば行列の					^置 元される場合がある って演習を含めた形で
[行列と線形 物理化学に 線形写像(演 講述する。 行列式と行 線形空間と	沢数の 現れる (算子)の 列 [2回] 行列 [2]	技法 (担当 諸問題は1)具体的な 回]	<u>当:</u> 伊萠 しばし	<u>-</u> [6)] .ば行列の					
[行列と線形 物理化学に: 線形写像(演 講述する。 行列式と行	(代数の 現れる) (算子)の 列 [2回] 行列 [2] 値問題]	技法 (担当 諸問題は 1) 具体的な 可] [1回]	<u>当</u> :伊藤 しばし な表現	。 [ば行列の としての	行列に	ONT.			
「行列と線形 物理化学に: 線形写像(演 講述する。 行列式と行 線形空間と 行列の固有	バ(数の) 現れる (算子)の 列 [2回] 行列 [2] 値問題 の確認	技法 (担当 者問題は1)具体的な [1回] (ヒュツ [*] [1回]	当:伊 しば し し ま 現 ケ ル 行	。 [ば行列の としての	行列に	ONT.			
行列と線形 物理化学に満 線形写する。。 行列式と行 線形空間と 行列の固 行列の固 有 行列の 回 置 換 案 解 析 数 と 切 の に 学 に 準 に 第 に 学 に 第 に 学 に つ 制 式 と 行 に 等 に 二 、 に 学 い 二 、 二 等 二 、 二 、 二 、 二 、 二 、 二 、 二 、 二 、	(代数の (算子)の 列 [2回] 列 [2] 列 [2] 同 刊 [2] 間 問 題 2 の理 注 を複) (4 (4) (5) の () の () の () の () の () の () の () の () の () の () の () の () の () の の () の の () の の () の の () の の () の () の の の () の の の の の () の の の の の の の の の の の の の	技法(担	当:伊 唐 し よ 表 現 ケ ル 行 る。)] る 1 変	[] [ば行列の としての 一 初の対角	行列に 自化) [1回 周数論の	らいて、 可	以下の	各項目につい 下のような*	
市列と線ディスト 市列と線ディスト 市動電子の 市動電子の 市会の 市会の にて、 のの のの のの のの のの のの のの のの のの の	(代数の) (行現(算子)の 列 [2回] 列 [2] [2] 一 列 [2] 一 間 問 距 2 の理 社会を満) 数関数(技法(担	当し は 表 し よ 表	* ば行列の としての 列の対角 理を用い	行列に [、] 身化)[1回 関数論の 和 た 各種	 型] 基礎にこ 定積分の 	以下の	予项目につい 下のような・ できるようり	って演習を含めた形で サブテーマに沿って演

と学数学I(先端化学)(2)	化学数学I(先端化学)(3)
遺分定理と積分公式 [I回] 复素関数の積分定理や積分公式を理解し導出できるようにする。	注意:「化学数学I(工業基礎化学)」を、すでに単位修得した学生が「化学数学I(先端化学)」
复素関数列 [1回] 复素関数列の性質と収束の概念を理解する。関数列の収束について議論できるようにする。	を履修し単位修得した場合、増加単位となる。 *Please visit KULASIS to find out about office hours.
[素関数の整級数展開 [1回]]則な複素関数が整級数展開できることを理解し、整級数展開を利用できるようにする。	
]数定理 [1回] }異点の性質を理解し、留数定理を用いた計算ができるようにする。	
*習到達度の確認 [1回] *習内容の理解度を確認する。	
E期試験[1回]	
フィードバック [1回]	
[Course requirements] 自然現象と数学、全学共通科目 微分積分A・B、線形代数学A・B を履修していることが望ましい。	
[Evaluation methods and policy] 前半部分終了時に実施する確認テスト(50%)と定期試験(50%)の合計点をもって評価する.	
[Textbooks]	
Not used 受業中にプリント等を配布する。	
[References, etc.]	
(Reference books) 大岩正芳 『化学者のための数学十講』(化学同人)ISBN:9784759800081 薬森裕基 松澤秀則,筑紫格訳『マッカーリ化学数学』(丸善)ISBN:9784621088104 公田哲 『理工系の基礎数学5 複素関数』(岩波書店)ISBN:4000079751	
[Study outside of class (preparation and review)] 本シラバス記載の参考書等で、基本的な事項について予習しておくこと。さらに、授業中に配布さ れるプリントや参考書中の演習問題を解き、内容について復習しておくこと。	
(Other information (office hours, etc.)) ナフィスアワーの詳細については、KULASISで確認してください。	
Continue to 化学数学Ⅰ(先端化学)(3)↓↓↓	

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Course numb	ber						
		化学) [工化1・ y II (Advanced Cl		Instructor's name, job t and depart of affiliation	itle, ment	Professor,SA Graduate Scl Associate Pro Graduate Scl Associate Profe Institute for	1001 of Engineering TO HIROFUMI 1001 of Engineering ofessor,ITOU AKIHIRO 1001 of Engineering ssor,HIGASHI MASAHIRO Chemical Research ZUOCHI NORIKAZU
Farget year	Brd year students	or above Number	of cred	its 2	Yea	r/semesters	2021/First semester
Days and periods	Wed.1	Class style	Lecture	e		Language of instruction	Japanese
[Overview ar	nd purpose o	of the course]					
		子軌道に基づく の演習を実施す		造及び分	子軌道	に基づく化学	結合論について講述
		->B(E) C)(E)	90				
[Course obje		Lafer	D == 001				· · · · · · · · · · · · · · · · · · ·
		hroedinger方程: ようになること		原子軌道	と分子	・軌道及びこれ	hらに基づいた原子
10							
[Course sche 波の性質と古!		•					
版の住員こ日 粒子性と波動							
分子の解析力	学【2回】						
分子の並進・	回転・振動お	よび電子の運動	り、Lagra	ange形式の)解析;	力学、Hamilt	on形式の解析力学
量子力学の基礎 状態、演算子、 ンシャルのScl	オブザーバ		、正準	交換関係、	不確	定性関係、自	自由粒子と井戸型ポテ
二原子分子の 調和振動子、		回】					
中間試験【1							
水素原子【1 水素原子と原							
多電子系と化 パウリの原理		】 その構造、分子輔	軌道の考	え方、等	核二原	子分子	
ヒュッケル法 π 共役系分子(ヒュッケル法					
より一般的化学		】 、多原子分子@)構造と	定性的分子	子軌道		
					,	Continue to 助理化学II	(先端化学) [工化1・工化3] (2)↓↓↓
					,	winiting to just()于II	(Volution) (Tipi Tipa) (5) + + +

物理化学Ⅱ(先端化学) [工化1・工化3](2)

学習到達度の確認【1回】 学習内容の理解度を確認する。

フィードバック【1回】

[Course requirements] 基礎物理化学A/基礎物理化学(量子論)および化学数学Iで取り上げた関連事項を修得している こと。

[Evaluation methods and policy] 平常点(50%)、期末試験(50%) 平常点には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。

[Textbooks] Not used

[References, etc.]

(Reference books) アトキンス物理化学(上)第8版 千原ら訳(東京化学同人)(ISBN 9784807906956) マッカーリ・サイモン物理化学 分子論的アプローチ(上)千原ら訳(東京化学同人)(ISBN 9784807905089)

[Study outside of class (preparation and review)] 講義内容の十分な理解には初歩的な数学が必要であり、講義内容と併せて適宜復習すること。また 同時期に開講される化学数学Ⅱを並行して履修することが望ましい。

(Other information (office hours, etc.))

【公開4目前の前面は前に4日の43% etc.) 量子力学の化学への応用体系を量子化学と呼ぶ。これは有機合成化学、高分子化学、無機化学ある いは触媒化学や有機金属化学、分子分光学を問わず、全ての化学の基盤となる。量子化学的素養は 現代の化学研究において必須であり、しっかり身につけて欲しい。

注意:「物理化学Ⅱ(工業基礎化学)」を、すでに単位修得した学生が「物理化学Ⅱ(先端化学)」 を履修し単位修得した場合、増加単位となる。

Course number Graduate School of Engineering Professor.SATO HIROFUMI (and course title in Physical Chemistry II (Advanced Chemistry) Instructors name, job title, and department of affiliation Graduate School of Engineering Associate Professor,ITOU AKIHIRO Graduate School of Engineering Associate Professor,ITOU AKIHIRO of affiliation	物理化学II (先端化学) [工化2・工化4] (2) 学習到達度の確認【1回】 学習内容の理解度を確認する。
Target year Brd year students or above Number of credits 2 Year/semesters 2021/First semester	フィードバック【1回】 [Course requirements]
Days and periods Wed.1 Class style Lecture Language distudior Japanese	基礎物理化学A/基礎物理化学(量子論)および化学数学1で取り上げた関連事項を修得している こと。
[Overview and purpose of the course] 量子力学の原理と応用、原子軌道に基づく原子構造及び分子軌道に基づく化学結合論について講述 し、必要に応じて関連事項の演習を実施する。 [Course objectives] 量子力学の基礎、簡単なSchroedinger方程式の例、原子軌道と分子軌道及びこれらに基づいた原子	[Evaluation methods and policy] 平常点(50%)、期末試験(50%) 平常点には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。 [Textbooks]
・分子の性質を理解できるようになること。	Not used
[Course schedule and contents] 波の性質と古典物理の破綻【1回】 粒子性と波動性、二重スリット実験	[References, etc.] (Reference books)
分子の解析力学【2回】 分子の並進・回転・振動および電子の運動、Lagrange形式の解析力学、Hamilton形式の解析力学 量子力学の基礎【3回】 状態、演算子、オブザーバブル、確率解釈、正準交換関係、不確定性関係、自由粒子と井戸型ポテ	その他 アトキンス物理化学(上)第8版 千原ら訳(東京化学同人) (ISBN 9784807906956) マッカーリ・サイモン物理化学 分子論的アプローチ(上)千原ら訳(東京化学同人) (ISBN 9784807905089)
れ感、視鼻子、オノリーハノル、唯単層杯、正半叉換関係、小唯足比関係、自由粒子と升戸室本ノ ンシャルのSchroedinger方程式	[Study outside of class (preparation and review)]
二原子分子の量子力学【1回】 調和振動子、剛体回転子	講義内容の十分な理解には初歩的な数学が必要であり、講義内容と併せて適宜復習すること。ま 同時期に開講される化学数学IIを並行して履修することが望ましい。
中間試験【1回】	(Other information (office hours, etc.)) 量子力学の化学への応用体系を量子化学と呼ぶ。これは有機合成化学、高分子化学、無機化学あ いは触媒化学や有機金属化学、分子分光学を問わず、全ての化学の基盤となる。量子化学的素養
水素原子【1 回】 水素原子と原子軌道	現代の化学研究において必須であり、しっかり身につけて欲しい。
多電子系と化学結合【2回】 バウリの原理、多電子原子の構造、分子軌道の考え方、等核二原子分子	注意:「物理化学II(工業基礎化学)」を、すでに単位修得した学生が「物理化学II(先端化学) を履修し単位修得した場合、増加単位となる。
ヒュッケル法【2回】 π共役系分子の分子軌道、ヒュッケル法	*Please visit KULASIS to find out about office hours.
より一般的化学結合【1回】 異核二原子分子の化学結合、多原子分子の構造と定性的分子軌道	
Continue to 物理化学II(先期化学) [I1(12・I1(ka] (2)↓↓	
I	

Course title (and course title in English)				[工化1・1 Ivanced Che		nam and	uctor's e, job tit departm filiation	nent	Professor,SU Graduate Scl	nool of Engineering GINOME MICHINOR nool of Engineering ssor,FUJIHARA TETSUAK
Farget yea	r Brd y	ear student	s or above	Number	of cred	its	2	Year	/semesters	2021/First semester
Days and peri	ods Wed	.2	Class	s style	Lecture	e			Language of instruction	Japanese
するために 年後期に開 有機化合物 として脱離	す必講の基パート	らゆる分 可るの な 有 板 の の の の の の の の の の の の の の の の の の	う野(学 「 戦化学Ⅲ し な の し れ 作 他 一 二 の 他 他 一 二 一 一 他 一 二 一 二 一 一 一 一 一 二 一 一 一 二 一 二 一 二 一 二 一 二 一 二 一 二 一 二 一 二 一 二 二 二 二 二 二 二 二 二 二 二 二 二	 ・産・官 ぐの基礎を は、大き には、大き には、大き には、 	系統的 く3つ (、立体 の π 電	に アキャッシュ ドラシン ドラシン ドラシン ほうしん いっぽう しょう じょう しょう しょう じょう しょう しょう しょう しょう しょう しょう しょう しょう しょう し	ぶため - トかつ 実 す	に、 ら構成 「 核反」	有機化学I,II, 成されている 概説する。第 換反応と脱离	行として第一線で活躍 111が2年後期から3 。最初のパートでは う2のパートでは、主 反応について詳述す 特にアルケン、エノ
	機化学 礎的な や、合	[および] 知識を, 成に際し	より実 しての反	ミ践的なレ 反応設計を	ベルヘ	飛躍	的に発	展さ・	せることを目	機化学基礎及び演習 目標としている。反応
の対称性/ 求核置換反	光学分 応,2回	割(14〕	章)						心を持たない 雛と転位(1	トキラル化合物/分子 5章)
脱離反応,2 置換と脱離 異性/E2反	におよ					反応	/脱冑	推基の	役割/脱離の	D立体選択性と立体特
前半の講義	内容に	関連する	\$演習,	1回						
アルケンに 臭素化/エ ハロラクト	ポキシ	化/求電	這子付加	の位置お		体選	択性/	(共役)	ジエンに対す	「る付加/反応機構/
エノール及 ケトエノー ートを中間 反応/エノ	ル互変 体とす	異性/酢 る反応/	後及び塩 /安定な	基触媒に エノラー	よるエ ト等価	ノー 体/	ル化/ エノー	安定さ	なエノール/ よびエノラー	´エノール及びエノラ -トの酸素原子上での

有機化学II(先端化学) [工化1・工化3](2)

L 求電子芳香族置換反応,2回 ペンゼンの求電子置換反応/フェノールの求電子置換反応/アニリン誘導体の求電子置換反応/オ ルト・パラ配向性及びメタ配向性/求電子置換反応の選択性(21章)

全体の講義内容に関連する演習,1回

フィードバック講義,1回 本講義の全体の振返りと試験の講評。

[Course requirements] 基礎有機化学I,II、有機化学基礎及び演習、有機化学Iで学んだ内容が習得されていることを前提に 講義を行う。

[Evaluation methods and policy] 【評価方法】毎回の講義で小テストを行うとともに、次回の講義前にレポートとして提出する課題 を与える。小テスト、レポートおよび演習に基づく平常点(30点)、および定期試験(70点) を総合して評価する。

【評価方針】到達目標について、工学部の成績評価の方針に従って6段階の成績評点で評価する。

[Textbooks] Jonathan Clayden他『Organic Chemistry (Second Edition)』 (Oxford University Press) ISBN: 9780199270293 ((14、15、17、19、20、21章を中心に取り扱う))

[References, etc.]

(Reference books) 柴崎正勝ら 『マクマリー有機化学ー生体反応へのアプローチー』(東京化学同人) ISBN: 9784807906918 ((基礎有機化学I,IIで用いた教科書))

[Study outside of class (preparation and review)] 予習:各回の授業を受ける前に、基礎有機化学I,IIおよび有機化学基礎および演習ですでに学んだ関 連する内容につき、復習しておくこと。 復習:授業で課された課題の全てを自らの手で解き、自らの理解度を確認すること。もし理解が不 足している時には、教科書やノートを確認して、確実に理解すること。

(Other information (office hours, etc.)) 受講生を2クラスに分け、クラス毎に定められた教員により授業を進める。

注意:「有機化学II(工業基礎化学)」を、すでに単位修得した学生が「有機化学II(先端化学)」 を履修し単位修得した場合、増加単位となる。

Course number		有機化学II(先端化学) [工化2・工化4](2)
	nstitute for Chemical Research rofessor,MURATA YASUJIROU	求電子芳香族置換反応2回 ベンゼンの求電子置換反応/フェノールの求電子置換反応/アニリン誘導体の求電子置換反応/オ ルト・パラ配向性及びメタ配向性/求電子置換反応の選択性(21章) 全体の講義内容に関連する演習、1回
Target year Brd year students or above Number of credits 2 Year/s	emesters 2021/First semester	
Days and periods Wed.2 Class style Lecture	Language of instruction Japanese	フィードバック講義,1回 本講義の全体の振返りと試験の講評。
[Overview and purpose of the course]		
化学が関係するあらゆる分野(学・産・官)で、自立した研究者お	よび技術者として第一線で活躍	
するために必要不可欠な有機化学の基礎を系統的に学ぶために、有 年後期に開講される。有機化学Ⅱは、大きく3つのパートから構成 有機化合物の立体化学や反応の立体選択性,立体特異性について概	されている。最初のパートでは	基礎有機化学I,II、有機化学基礎及び演習、有機化学Iで学んだ内容が習得されていることを前提に 講義を行う。
有機に古物の立体化子や反応の立体選択性、立体特異性について概として脱離基を有する飽和有機化合物の反応性を取扱い、求核置換	成9る。第2000~Freは,王 反応と脱離反応について詳述す	[Evaluation methods and policy]
る。第3のパートでは,不飽和有機化合物のπ電子が関与する反応 ール,芳香族化合物に対する求電子的反応について講述する。		【評価方法】毎回の講義で小テストを行うとともに、次回の講義前にレポートとして提出する課題 を与える。小テスト、レポートおよび演習に基づく平常点(30点)、および定期試験(70点) を総合して評価する。
[Course objectives] 本講義は有機化学IおよびIIIと密接に連携して行い,基礎有機化学I,	Ⅱおよび有機化学基礎及び演習	【評価方針】到達目標について、工学部の成績評価の方針に従って6段階の成績評点で評価する。
で養った基礎的な知識を、より実践的なレベルへ飛躍的に発展させ	ることを目標としている。反応	Press to a lost
機構の考察や、合成に際しての反応設計を自ら行える能力を養う。		[Textbooks] Jonathan Clayden他『Organic Chemistry (Second Edition)』(Oxford University Press)ISBN:
[Course schedule and contents]		Jonathan Clayden他『Organic Chemistry (Second Edition)』(Oxford University Press) ISBN: 9780199270293((14、15、17、19、20、21章を中心に取り扱う))
・ 立体化学2回 鏡像異性体(エナンチオマー)/ジアステレオマー/不斉炭素中心	を持たないキラル化合物/分子	
の対称性/光学分割(14章)		[References, etc.]
求核置換反応.2回 求核置換反応の機構/ SN1反応と SN2反応/脱離基/求核剤/脱離	と転位(15章)	 (Reference books) 柴崎正勝ら 『マクマリー有機化学ー生体反応へのアプローチー』(東京化学同人) ISBN: 9784807906918 ((基礎有機化学I,IIで用いた教科書))
脱離反応,2回 置換と脱離におよぼす求核剤の効果/E1反応とE2反応/脱離基の役	割/脱離の立体選択性と立体特	
異性/E2反応の位置選択性/E1cB反応(17章)		[Study outside of class (preparation and review)]
前半の講義内容に関連する演習,1回		予習:各回の授業を受ける前に、基礎有機化学LIIおよび有機化学基礎および演習ですでに学んだ関 連する内容につき、復習しておくこと。 復習:授業で課された課題の全てを自らの手で解き、自らの理解度を確認すること。もし理解がイ
アルケンに対する求電子付加反応,2回 見素化/エポキシ化/求電子付加の位置および立体選択性/共役ジ シロークレン化にとて翌時度後の虚空(10章)	エンに対する付加/反応機構/	足している時には、教科書やノートを確認して、確実に理解すること。
ハロラクトン化による環状構造の構築(19章)		(Other information (office hours, etc.))
エノール及びエノラートの生成と反応2回 ケトエノール互変異性/酸及び塩基触媒によるエノール化/安定な ートを中間体とする反応/安定なエノラート等価体/エノールおよ 反応/エノールエーテルの反応(20章)		受講生を2クラスに分け、クラス毎に定められた教員により授業を進める。 注意:「有機化学II (工業基礎化学)」を、すでに単位修得した学生が「有機化学II(先端化学)」 を履修し単位修得した場合、増加単位となる。
	tinue to 有機化学II(先端化学) [I化2・I化4] (2)↓↓↓	*Please visit KULASIS to find out about office hours.

Course nu	umber									
Course title (and course) title in English)						nan and	tructor's ne, job ti I departn Iffiliation	tle, nent	Professor,AE Institute for lutte Professor,FU Graduate Scl Professor,OF Graduate Scl Associate Prof Graduate Scl Associate Prof Graduate Scl Institute for , Professor,FU Institute for , Associate Prof Graduate Scl Graduate Scl Graduate Scl	hool of Engineering BE TAKESHI grated Cell-Material Science IKAZAWA AIKO hool of Engineering HKI YASUHIRO hool of Engineering ofessor,MIXUI TOSHIAK hool of Engineering ofessor,MIXI KOUJI hool of Engineering Advanced Study RUKAWA SHIYUUHE Advanced Study fessor,HORIKE SATOSH hool of Engineering ter, TAKATSU HIROSH
Farget yea	r Brd y	ear students o	or above	Number	of cred	lits	2	Year	/semesters	2021/First semester
Days and perio	ods Mon.	.2	Class	s style	Lecture	e			Language of instruction	Japanese
金属錯体及 理解する	び有機会	金属化合	物のご	工体構造、	電子構	造、	電子ス	ペクト	トル、反応機	機構についての基礎を
[Course s										
19. d 金属錆 金属錯体(いて詳細に	特に d -	ブロック	の金属	属の錯体)	の電子			レの起	源を電子mir	nus電子間反発に基づ
20. 配位化学:錯体の反応,4回 d-ブロック錯体の反応機構を詳細に検討する。まず反応機構の分類について記述し、反応が起こ る名段階と、活性錯体が生成する機構の詳細を区別する。次いで、これらの概念を用いて錯体の置 換反応と酸化還元反応の機構を記述する。										
21.d 金属の d -ブロック 次いで、水	7有機金	属化合物	の基準							反応について述べる。
学習到達度 本講義の内			度を確	雀認(講 評	i) する					
			/					_c	 ontinue to 無機化学II	「洗��化学) [エ化1・エ化3] (2)↓↓

無機化学II(先端化学) [工化1・工化3] (2)

[Course requirements] 授業の前に該当の章ならびにシュライバー・アトキンス無機化学(上)1~7章を通読しておくこ

[Evaluation methods and policy] 平常点および期末試験にて評価する。

[**Textbooks**] シュライバー・アトキンス無機化学(下)[第6版] M.Weller, T.Overton J.P.Rourke, F.Armstrong 共著 田中勝久、高橋雅英、安部武志、平尾一之、北川進 共訳 東京化学同人(2017)ISBN: 9784807908998

[References, etc.]

(Reference books)

[Study outside of class (preparation and review)] 授業までに教科書をよく読んでおくこと

(Other information (office hours, etc.))

キーワード: d ーブロック錯体、電子スペクトル、電子間反発、配位化合物の構造、配位化合物の 反応機構、有機金属化合物

注意:「無機化学Ⅱ(工業基礎化学)」を、すでに単位修得した学生が「無機化学Ⅱ(先端化学)」 を履修し単位修得した場合、増加単位となる。

Course number	 無機化学II(先端化学) [工化2・工化4] (2)
Graduate School of Engineering	
Professor, ABE TAKESHI Institute for Integrated Cell-Material Sciences Professor, FUKAZAWA AIKO	[Course requirements] 授業の前に該当の章ならびにシュライバー・アトキンス無機化学(上)1~7章を通読しておくこ
Graduate School of Engineering Professor,OHKI YASUHIRO	
purse title Graduate School of Engineering Associate Professor,MATSUI TOSHIAKI	[Evaluation methods and policy] 出席および期末試験にて評価する。
md course 無機化学II(先端化学) [工化2・工化4] name, job title, Inorganic Chemistry II (Advanced Chemistry) and department Associate Professor,MIKI KOUJI	
glish) of affiliation Graduate School of Engineering Associate Professor, SAKAMOTO RYOTA	[Textbooks] シュライバー・アトキンス無機化学(下)[第6版] M.Weller, T.Overton J.P.Rourke, F.Armstrong 共著
Institute for Advanced Study Professor, FURUKAWA SHIYUUHEI	田中勝久、高橋雅英、安部武志、平尾一之、北川進 共訳 東京化学同人(2017)ISBN: 9784807908998
Institute for Advanced Study Associate Professor,HORIKE SATOSHI Graduate School of Engineering	
Senior Lecturer, TAKATSU HIROSHI	[References, etc.] (Reference books)
get year Brd year students or above Number of credits 2 Year/semesters 2021/First semester	
and periods Mon.2 Class style Lecture Language distuided Japanese	[Study outside of class (preparation and review)]
を開催した。 建無機化学と無機化学1を修得した後のアドバンスドコースとして、金属錯体及び有機金属化合 の配位化学について、構造、電子スペクトル、反応機構を講述する。	授業までに教科書をよく読んでおくこと
JULULチにしていて、何辺、电ナスパンドル、反応技術を調定する。	 (Other information (office hours, etc.)) キーワード: d ーブロック錯体、電子スペクトル、電子間反発、配位化合物の構造、配位化合物の
属錯体及び有機金属化合物の立体構造、電子構造、電子スペクトル、反応機構についての基礎を	反応機構、有機金属化合物
	注意:「無機化学Ⅱ(工業基礎化学)」を、すでに単位修得した学生が「無機化学Ⅱ(先端化学)」 を履修し単位修得した場合、増加単位となる。
purse schedule and contents] 1 金属錯体:電子構造とスペクトル,7回,金属錯体(特に d minusプロックの金属の錯体)の電子	*Please visit KULASIS to find out about office hours.
ペクトルの起源を電子minus電子間反発に基づいて詳細に学び、錯体の結合についての理解を深 い。	
紀位化学:錯体の反応,4回, d minusプロック錯体の反応機構を詳細に検討する。まず反応機構の について記述し、反応が起こる各段階と、活性錯体が生成する機構の詳細を区別する。次いで、	
いらの概念を用いて錯体の置換反応と酸化還元反応の機構を記述する。 d 金属の有機金属化合物,3回, d minusプロック有機金属化合物の基盤である金属カルボニル錯体	
特告、結合、反応について述べる。次いで、水素および炭化水素配位子の結合様式と反応性につ ご述べる。	
到達度の確認,1回,本講義の内容に関する到達度を確認(講評)する	
Continue to 無観化学II(先壩化学) [工化2・工化4] (2)↓↓	
Course number	生化学I(先端化学)(2)
urse title Instructor's Graduate School of Engineering Professor.ATOMI HARUYUKI	 細胞シグナル.2回
1 course 生化学I(先端化学) in Basic Biochemistry I (Advanced Chemistry) and department Professor,MORI YASUO	細胞とその外界をつなぐ情報の流れを解説する。
lish) of affiliation Graduate School of Engineering Professor,HAMACHI ITARU	学習到達度の確認,1回 *業業の内容に用する理解症を確認する
pet year Brd year students or above Number of credits 2 Year/semesters 2021/First semester	本講義の内容に関する理解度を確認する。
and periods Tue.1 Class style Lecture Language distuicion Japanese	[Course requirements]
erview and purpose of the course]	[Evaluation methods and policy]
を構成する分子を研究する生化学は、様々な学問分野との境界において重要な役割を果たす。 、医薬・物質生産や材料科学などの分野へも広く応用され、生化学は発展している。このよう し、のすびについて、地に使知のなどなどないしてよりだりませんとなる情報の問題が考慮。	課題とレポートにより評価する。
化学の基礎について、遺伝情報の流れであるセントラルドグマを中心に生命情報の制御を講義 とともに、生化学研究の予備的な知識を与える。	[Textbooks]
urse objectives]	Jeremy M. Berg, John L. Tymoczko, Lubert Stryer 『ストライヤー生化学』(東京化学同人)ISBN: 9784807908035(第7版)
学における「化学」の基礎知識の習得。	
urse schedule and contents] 学の基礎 1回	[References, etc.]
学とはどのような学問・研究分野であるのかなど、生化学の基礎的立場を説明する。	(Reference books)
パク質の成り立ち.2回 反応の制御を直接担うタンパク質の組成、構造の基礎について説明する。	
トラルドグマと遺伝情報の流れ、2回	[Study outside of class (preparation and review)] 教科書等を読み、講義で学ぶことを事前に把握するとともに、講義中に十分理解できなかった箇所
プDNAからRNA、タンパク質への遺伝情報の流れであるセントラルドグマの基礎について説明。	我科音号を読め、調報で子ふここを事前に把握するここもに、調報中に「万理解できなかうた固かの 理解に努める。
の複製、組換え、修復.1回	(Other information (office hours ate))
うのなる、細胞に、しめに、ロークションのであるのである。 アの分子実体であるDNAがどのように複製され、また、どのようにDNA組換え・変異が生じ されるかについて解説する。	(Other information (office hours, etc.)) 教科書の全範囲を授業で取り上げることはできないので、生命情報の制御を中心に講義をするが、
の合成と遺伝子発現.2回	授業で触れなかった項目についても、教員の指示に応じて学習しておくこと。
いて山水と風伝してあるRNAが転写により合成され、その後のプロセッシンングを経て成熟する過 「解説する。また、転写を中心に、遺伝子発現の調節機構について解説する。	注意:「生化学 I (工業基礎化学)」を、すでに単位修得した学生が「生化学 I (先端化学)」を 履修し単位修得した場合、増加単位となる。
所前する。また、転手を中心に、 題広于光境の調助破酷に ラバ C 解説する。 パク質の合成2回	*Please visit KULASIS to find out about office hours.
の担う遺伝情報が翻訳されタンパク質が合成される過程を解説する。	[Courses delivered by instructors with practical work experience]
1.1回 1を構成する重要な生体高分子の一つである糖質の構造と機能について解説する。	(1) Category A course with practical content delivered by instructors with practical work experience
ここのパイマ主文の上に回力コンニンとの少加良い時度に以比にフィント所成する。	

脂質と生体膜,1回 細胞と外界との境界や細胞内の区画を形作る生体膜とその構成分子である脂質について解説する。

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

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

		ìI(先端化学) Chemistry I (Advance		ctor's job title, epartment		nool of Engineering GOSHI TOMOKI		第14回 開環重合 開館重合について リマーについて説
English)		, · (of affi	liation				りゃーに りいて 説 <<期末試験>>
Target year	3rd year students	or above Numbe	r of credits 2	Yea	r/semesters	2021/First semester		第15回 フィード
Days and periods	Thu.2	Class style	Lecture		Language of instruction	Japanese		-
		of the course]						[Course required 有機化学の知識を
高分子化合物 う 前光では	の概念の確立 出表的た喜分	と発展の歴史	を振り返ったま つである逐次詞	5と, 高分 言会 (重編	子合成法に関 合 重付加	する入門的解説を行 付加縮合)について		月惯化子の知識を
概説する. 後	半では連鎖重	合の中で重要	な位置を占める	らラジカル	重合、イオン	重合,配位重合,開		[Evaluation meth
環重合につい	て解説する.	最近の高分子	化学に関する丨	ピックも	紹介する.			[評価方法] 小テストに基づく
[Course obje	ctives]						1	[評価方針]
高分子の定義							1	100点満点中、 60点以上:合格
高分子合成の	基礎知識を習	得する.						59点以下:不合
[Course sch	edule and co	ontents]					1	[Textbooks]
高分子の定義 高分子化学・	、特性, 多様 工業に育って	概念と高分子合 な分子構造に きたかを述べ る逐次重合,	ついて概説し, る. また, 高分	子の平均	分子量につい	こうに生まれ,現在の いての概念について解		Not used
重縮合による と分子量分布	高分子合成反 の制御につい	ても解説する.	ドとポリエスラ 重付加による	高分子合	成をエポキシ	E成ポリマーの分子量 樹脂とポリウレタン 給についても触れる.		[References, etc (Reference bo 中條 善樹 他「
第7回 前半の 前半の内容に		る中間試験 『験を行い,学 [:]	習到達度の確認	恩を行う.				[Study outside c 予習:高分子化学 復習:授業で課さ 解が不足している
第8回-第10回 ラジカル重合 停止などの素	の定義を述べ		マーと開始剤の モノマー反応性)種類, ラ 挂比などに	ジカル重合の ついて講述す	0特徴,開始・生長・ -る.		解すること. (Other informat
	アニオン重合			種類につい	て述べる. と	:くに, すでに学んだ		メールによる対応 注意:「高分子化
第13回 配位 配位重合の代		・レフィン類の2	Ziegler-Natta重	合並びに立	在特異性重	合について概説する.		(先端化学)」を履 *Please visit KULA
						- 化学概論 (先端化学) (2)↓↓↓]	

先端化学)(**2**)

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ 既説し,環状エーテル,ラクトン,ラクチドなどの環状モノマーから得られるポ する

ベック

ents]

得しておくこと

ds and policy]

2常点(10%),中間試験(40%),期末試験(50%)の成績を主に判定する. 0点以上となること

高分子化学合成編』(丸善出版)ISBN:978-4-621-08259-1

class (preparation and review)] D基となる有機化学について復習しておくこと. れた小テストなど全てを自らの手で解き、自らの理解度を確認すること.もし理 寺には、授業で配布されたハンドアウト、参考書やノートを確認して、確実に理

n (office hours, etc.))

(概論 I (工業基礎化学)」を、すでに単位修得した学生が「高分子化学概論 I 修し単位修得した場合、増加単位となる。

IS to find out about office hours

有機化学Ⅲ(先端化学) [工化1・工化3](2)

conjugated dienes, and selectivity of direct additions and conjugate additions, etc. (Chapter 24).

Alkylation reactions of enolates, 3 sessions

Lectures are given on the alkylation of nitriles and nitroalkanes, electrophiles used for alkylation, alkylation of lithium enolates, alkylation using enolate equivalents, alkylation of & beta; -dicarbonyl compounds, and regioselectivity in the alkylation of ketones, etc. (Chapter 25).

Reactions of enolates and carbonyl compounds: aldol reactions and Claisen condensation, 3 sessions Lectures are given on aldol reactions, cross-aldol condensation, aldol reactions using enolates and enolate equivalents, intramolecular aldol reactions, acylation reactions of enolates, Claisen condensation, cro Claisen condensation, and intramolecular crossed Claisen condensation, etc. (Chapter 26).

Confirmation of learning achieved, 1 session Students' understanding of chapters 22 to 26, which are covered in lectures, is confirmed. Explanation of examinations and lectures, 1 session tudents' understanding of organic chemistry as a whole is enhanced.

[Course requirements]

Lecture contents from Basic Organic Chemistry I, Basic Organic Chemistry I, Organic Chemistry I (Advanced Chemistry), and Organic Chemistry II (Advanced Chemistry)

[Evaluation methods and policy] Regular examinations (85%), performance in teaching sessions (15%)

[Textbooks]

Clayden, J., Greeves, N., Warren S., Organic Chemistry, 2nd Ed., (Oxford University Press, 2012) ISBN: 9780199270293

[References, etc.]

(Reference books) Others; McMurry, J. (translated by Shibasaki, M., Iwasawa, S., Owada, T., Mashino, T.), Makumarii yuuki kagaku - seitai hannou he no apuroochi, (Tokyo Kagaku Dojin, 2009) ISBN: 9784807609918

[Study outside of class (preparation and review)]

A report assignment is given in each teaching sess

(Other information (office hours, etc.))

Students are divided into two classes and each class is assigned a professor who will conduct teaching essions in the same time slot.

Regioselectivity, 2 sessions Lectures are given on regioselectivity in electrophilic aromatic substitution reactions, electrophilic attacks on alkenes, regioselectivity of radical reactions, nucleophilic attacks on allyl compounds, electrophilic attacks on Continue to 有機化学Ⅲ(先端化学) [工化1・工化3] (2)↓↓

Course number

有機化学Ⅲ(先端化学) [工化1・工化3]

Organic Chemistry III (Advanced Chemistry

Brd year students or above Number of credits 2

Lecture

In this subject, a systematic approach is taken to teach students about organic chemistry, which is needed in order for them to work as researchers and engineers. Since Organic Chemistry III is a continuation of Organic Chemistry I, which is offered in the second half of sophomore year, and Organic Chemistry II, which is the second half of sophomore year.

offered in the first half of junior year, the subject uses the same textbook as Organic Chemistry I and II and conducts lectures based on the contents described in Chapters 22 to 26 of the textbook. During lectures, students are given a detailed explanation of reactions that are characteristic of electron-deficient alkenes and

aromatic compounds, and are taught about the protection and deprotection of functional groups essential for the synthesis of complex organic molecules. In addition, in order to help students understand the chemistry of

carbonyl compounds, which are one of the most important types of compounds in organic chemistry, lectures

Goals include deepening one s understanding of the reactions of aromatic compounds, systematically understanding the reactivity of functional groups, as well as completely mastering the chemistry of carbonyl

ompounds, which are one of the most important types of compounds in organic chemistry (alkylation eactions of enolates, aldol condensation reactions, and other condensation reactions, etc.). In the process of

Lectures are given on conjugate addition reactions, conjugate substitution reactions, nucleophilic epoxidation, aromatic nucleophilic substitution reactions, addition-desorption mechanisms, and reactions that use

Lectures are given on reducing agents, reduction of carbonyl compounds, catalytic hydrogenation reactions, reduction via molten metal, selectivity in oxidation reactions, reactivity of functional groups, and protection/

reaching these goals, students will also consolidate the contents they have learned so far from Organic Chemistry I and II, and will strive to master a high level of organic chemistry, which they absolutely need in order to work as researchers and engineers at the forefront of society.

Conjugate addition reactions and aromatic nucleophilic substitution reactions, 3 session

liazonium compounds and benzyne as intermediates, etc. (Chapter 22).

Class style

Course tit

title in

English)

and cours

Farget year

Days and periods Tue.2

[Course objectives]

[Course schedule and contents]

Themoselectivity and protecting groups, 3 sessions

eprotection of functional groups, etc. (Chapter 23).

[Overview and purpose of the course]

are given with a focus on the varied reactivity of enolates.

未更新

Graduate School of Engineering Professor,KONDOU TERUYUKI

Graduate School of Engineering Associate Professor, OOMURA TOSHIMICH

Graduate School of Engineering Associate Professor, KIMURA YUU

Japanes

Year/semesters 2021/Second semester

inguage of instruc

name, job title, and department of affiliation

_____Continue to 有機化学Ⅲ(洗漏化学) 〔I1化T・I1化3〕(3) ↓↓

	Course number
Please visit KULASIS to find out about office hours.	Course title (and course 有機化学III(先端化学)〔工化2・工化4〕 Instructors name, job title, Graduate School of Engineering Graduate School of Engineering Graduate School of Engineering
ourses delivered by instructors with practical work experience] Category Category	title in English) Organic Chemistry III (Advanced Chemistry) and department of affiliation of affiliation Associate Professor,OOMURA TOSHIM Graduate School of Engineering Associate Professor,KIMURA Y
course with practical content delivered by instructors with practical work experience	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second seme
Details of instructors' practical work experience related to the course	Days and periods Tue.2 Class style Lecture Langua distution Japanese
Details of practical classes delivered based on instructors' practical work experience	[Overview and purpose of the course] 研究者および技術者として活躍するために必要な有機化学を系統的に教授する。有機化学IIでは 2回生後期開講の有機化学1、3回生前期閉講の有機化学IIの後継講義として、これらの講義とF 教科書を使い、同書の22章から26章に記載の内容を講義する。電子不足アルケンや芳香族化合物 特徴的な反応について詳説するとともに、複雑な有機分子の合成に必須となる官能基の保護・閉 護について述べる。また、有機化学において最も重要な化合物の一つであるカルボニル化合物の 学を理解するために、エノラートの多彩な反応性に注目しつつ講義を進める。
	[Course objectives] 芳香族化合物の反応に理解を深め、官能基の反応性について系統的に理解するとともに、有機化 において最も重要な化合物の一つであるカルボニル化合物の化学(エノラートのアルキル化反応 アルドール縮合反応、および他の縮合反応等)を完全に修得する。その過程においてこれまでに んだ有機化学1, 11の内容を統合し、研究者,技術者として社会の最先端で活躍するために不可ク 高水準の有機化学を修得する。
	[Course schedule and contents] 其役付加反応と芳香族求核置換反応、3回 其役付加反応、共役置換反応、求核的エポキシ化、芳香族求核置換反応、付加-脱離機構、およ ジアゾニウム化合物、ペンザインを中間体とする反応等について講義する(22章)
	化学選択性と保護基:3回 還元剤、カルボニル化合物の還元、触媒的水素化反応、溶融金属による還元、酸化反応における 択性、官能基の反応性、官能基の保護・脱保護等について講義する(23章)
	位置選択性.2回 芳香族求電子置換反応における位置選択性、アルケンへの求電子攻撃、ラジカル反応の位置選択 アリル型化合物への求核攻撃、共役ジエンへの求電子攻撃、直接付加と共役付加の選択性等につ て講義する(24章)
	エノラートのアルキル化反応,3回 ニトリルおよびニトロアルカンのアルキル化、アルキル化に用いる求電子剤、リチウムエノラ- のアルキル化、エノラート等価体を用いるアルキル化、beta-ジカルボニル化合物のアルキル化、 トンのアルキル化における位置選択性等について講義する(25章)
	エノラートとカルボニル化合物の反応:アルドール反応およびClaisen縮合,3回 Continue to 積肥剤 (圧化・圧体) (
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反	Course number Course title (and course 物理化学III(先端化学) Instructor's name, job title, Graduate School of Engineering Graduate School of Engineering
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。	Course title Instructor's Graduate School of Engineering Associate Professor,SUGASE KI
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 験・講義についての解説,1回,有機化学全般の理解について到達度を上げる。	Course title (and course) title in English) 初理化学III(先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor,SUGASE AI, Graduate School of Engineering Associate Professor,MEYAMA TOMOK Graduate School of Engineering Associate Professor,MEYAMA TOMOK Graduate School of Engineering Associate Professor,MEYAMA TOMOK Graduate School of Engineering Senior Lecturer,HIGASHIGUCHI K Target year ard year students or above Number of credits 2 Year/semesters 2021/Second seme 2021/Second seme Days and periods [Overview and purpose of the course] Lecture Lagage/Instructor Japanese
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認、1回,講義を行った22章から26章の学習到達度を確認する。 驗・講義についての解説、1回,有機化学全般の理解について到達度を上げる。 Sourse requirements] 礎有機化学 I,基礎有機化学 I,有機化学 I (先端化学),有機化学 I (先端化学)の講義内容 Evaluation methods and policy]	Course title (and course title in English) 物理化学III(先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department, of affiliation Graduate School of Engineering Associate Professor, SUGASE KI Graduate School of Engineering Senior Lecturer, HIGASHIGUCHI K Target year Brd year students or above Tue.1 Number of credits 2 Year/semesters 2021/Second seme Japapa distictor Days and periods [Overview and purpose of the course] Lecture Japapa distictor Japanese
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 験・講義についての解説,1回,有機化学全般の理解について到達度を上げる。 Sourse requirements] 礎有機化学1,基礎有機化学1,有機化学1(先端化学),有機化学1(先端化学)の講義内容 Evaluation methods and policy] 期試験(85%)、平常点評価(15%)	Course title (and course title in English) 物理化学III (先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AI Graduate School of Engineering Associate Professor, JUMEY ANA TOMOK Graduate School of Engineering Senior Lecturer, HIGASHIGUCHI K Target year Jird year students or above Days and periods Tue.1 Number of credits 2 Year/semesters 2021/Second seme Days and periods in this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. Instructor's Associate Professor, JUMEY ANA TOMOK Graduate School of Engineering Senior Lecturer, HIGASHIGUCHI K In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. ICourse objectives]
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 験・講義についての解説,1回,有機化学全般の理解について到達度を上げる。 Course requirements] 礎有機化学 I,基礎有機化学 I,有機化学 I (先端化学),有機化学 I (先端化学)の講義内容 Evaluation methods and policy] 期試験(85%)、平常点評価(15%) Fetbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN	Course title (and course title in English) 物理化学III(先始化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AI Graduate School of Engineering Associate Professor, UMEYAMA TOMOK Graduate School of Engineering Senior Lecturer, HGASHIGUCH K Target year rd year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture Impage/Instructure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. [Course objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. [Course schedule and contents] Basics of spectroscopy, 1 session Basics of spectroscopy, 1 session [Statistical thermodynamics.
 働化学Ⅲ (先端化学) [I(L2・I(L4) (2) ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差代ascn縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 繁・講義についての解説,1回,有機化学全般の理解について到達度を上げる。 Course requirements] 礎有機化学 I, 基礎有機化学 I (先端化学),有機化学 I (先端化学)の講義内容 Evaluation methods and policy] (#新歌 (85%)、平常点評価 (15%) Fextbooks] rganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 9780199270293 References, etc.] (Reference books) クマリー 有機化学 一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, 増野匡彦 監訳;東京化学同人, 2009) ISBN:9784807906918 	Course title (and course title in English) 物理化学III(先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AI Graduate School of Engineering Associate Professor, UMEYAMA TOMOK Graduate School of Engineering Senior Lecturer, HIGASHIGUCHI K Target year rd year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture angaptitistic Japanese [Overview and purpose of the course] Lecture angaptitistic Japanese In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. Gourse objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. Basics of spectroscopy, 1 session What is spectroscopy, optical absorption and quantum mechanics, Einstein coefficients Rotational and vibrational spectra, 4 sessions Rotational and spectra, spectra, vibrational energy levels and spectra, lasers, symmetry and normal vibration, Raman spectrum
 ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する (26章) 踏到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 後、講義についての解説,1回,有機化学全般の理解について到達度を上げる。 ourse requirements] 菱着有機化学 Π, 基礎有機化学 Π, 有機化学 Ι (先端化学), 有機化学 Π (先端化学)の講義内容 valuation methods and policy] 明試験 (85%)、平常点評価 (15%) extbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 1780199270293 eferences, etc.] (Reference books) クマリー 有機化学 巨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 増野国彦 監訳 ; 東京化学同人, 2009) ISBN:9784807906918 tudy outside of class (preparation and review)] 	Course title (and course title inglish) 物理化学III (先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AU Graduate School of Engineering Associate Professor, Sufficients In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. ICourse objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. ICourse schedule and contents] Basics of spectroscopy, optical absorption and quantum mechanics, Einstein coefficients Rotational and vibrational spectra, 4 sessions Rotational and vibrational spectra, vibrational energy levels and spectra, lasers, symmetry and normal vibration, Raman spectrum Electronic transitions and photochemistry, 2 sessions Electron band spectrum, photochemical principles, fluorescence and phosphorescence, photochemical cha reactions, p
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 智到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 錄 · 講義についての解説,1回,有機化学全般の理解について到達度を上げる。 ourse requirements] 還有機化学 I、基礎有機化学 II、有機化学 I(先端化学),有機化学 II(先端化学)の講義内容 valuation methods and policy] 明試験(85%)、平常点評価(15%) extbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 9780199270293 efferences, etc.] (Reference books) クマリー 有機化学 一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 増野匡彦 監訳 : 東京化学同人, 2009) ISBN:9784807906918 tudy outside of class (preparation and review)] 業年に課題レポートを課す。 Other information (office hours, etc.))	Course title (and course title in English) 物理化学III (先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AI Graduate School of Engineering Associate Professor, JUMEY AMA TOMOK Graduate School of Engineering Senior Lecturer/HGASHIGUCHI K Target year ad year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture Impage/Instruct 2021/Second seme In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. Impage/Instructure, rotational and vibrational spectroscopy, 1 session What is spectroscopy, optical absorption and quantum mechanics, Einstein coefficients Rotational and vibrational spectra, 4 sessions Rotational and vibrational spectru, vibrational energy levels and spectra, symmetry and normal vibration, Raman spectrum Electronic transitions and photochemistry, 2 sessions Electron bad spectrum, photochemistry, 2 sessions
 レドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する (26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 後、講義についての解説,1回,有機化学全般の理解について到達度を上げる。 ourse requirements] 遊石機化学 I, 基礎有機化学 II, 有機化学 I (先端化学), 有機化学 II (先端化学)の講義内容 valuation methods and policy] 明試験 (85%)、平常点評価 (15%) extbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 1780199270293 eferences, etc.] (Reference books) ウマリー 有機化学 一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 増野匡彦 監訳;東京化学同人, 2009) ISBN:9784807906918 tudy outside of class (preparation and review)] 案毎に課題レポートを課す。 Other information (office hours, etc.)) 溝生を 2 クラスに分け、クラス毎に定められた教員により同じ時間帯に授業が行われる。 ease visit KULASIS to find out about office hours. 	Course title (and course title in English) 物理化学III(先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor,UMEYAMA TOMOK Graduate School of Engineering Associate Professor,UMEYAMA TOMOK Graduate School of Engineering Senior Lecturer,HIGASHIGUCHI K Target year ird year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture upagatistude Japanese [Overview and purpose of the course] In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. [Course objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. [Course schedule and contents] Basics of spectroscopy, optical absorption and quantum mechanics, Einstein coefficients Rotational and vibrational spectra, 4 sessions Rotational and vibrational spectrum, photochemistry, 2 sessions Electronic transitions and photochemistry, 2 sessions Electron band spectrum, photochemical principles, fluorescence and phosphorescence, photochemical char reactions, photolysis, photosynthesis Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnet
 レドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26⁹) 摺到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 後、講義についての解説,1回,有機化学全般の理解について到達度を上げる。 ourse requirements] 差有機化学 I,基礎有機化学 II,有機化学 I (先端化学),有機化学 I (先端化学)の講義内容 valuation methods and policy] 期試験 (85%)、平常点評価 (15%) extbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 7780199270293 eferences, etc.] (Reference books) クマリー 有機化学 一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 増野匡彦 監訳;東京化学同人, 2009) ISBN:9784807906918 tudy outside of class (preparation and review)] 案毎に課題レポートを課す。 Other information (office hours, etc.]) 溝生を 2 クラスに分け、クラス毎に定められた教員により同じ時間帯に授業が行われる。 ease visit KULASIS to find out about office hours. ourses delivered by instructors with practical work experience 	Course title (and course title in English) 所理化学III(先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, SUGASE AU Graduate School of Engineering Senior Lecture/HIGASHIGUCHI K Target year Jrd year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture Impage/Instruct 2021/Second seme In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. Impage/Instructure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. ICourse schedule and contents] Basics of spectroscopy, optical absorption and quantum mechanics, Einstein coefficients Rotational and vibrational spectra, vibrational energy levels and spectra, lasers, symmetry and normal vibration, Raman spectrum Electronic transitions and photochemistry, 2 sessions Electronic transitions and photochemistry, 2 sessions Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic re
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 褶到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 験・講義についての解説,1回,有機化学10,520章の学習到達度を確認する。 験・講義についての解説,1回,有機化学11(先端化学),有機化学II(先端化学)の講義内容 waluation methods and policy] 開試験 (85%)、平常点評価 (15%) extbooks] ganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 9780199270293 Heferences, etc.] (Reference books) 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 , 増野匡彦 監訳 : 東京化学同人, 2009) ISBN:9784807906918 Hudy outside of class (preparation and review)] 業毎に課題レポートを課す。 Other information (office hours, etc.)) 講生を2クラスに分け、クラス毎に定められた教員により同じ時間帯に授業が行われる。 lease visit KULASIS to find out about office hours. Fourses delivered by instructors with practical work experience Details of instructors' practical work experience	Course title (and course title in English) 所理化学III(先端化学) (先端化学) Physical Chemistry III (Advanced Chemistry) Instructor's name, job title, and department of affiliation Graduate School of Engineering Associate Professor, JUMEY AMA TOMOK Graduate School of Engineering Senior Lecture/HIGASHIGUCHI K Target year ad year students or abov Number of credits 2 Year/semesters 2021/Second seme Days and periods Tue.1 Class style Lecture Impact III (Advanced Chemistry) 2021/Second seme In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. Impact III (Advanced Chemistry) ICourse objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. Impact III (Advanced Advanced
ルドール反応、交差アルドール縮合、エノラートおよびエノラート等価体を用いるアルドール反 、分子内アルドール反応、エノラートのアシル化反応、Claisen縮合、 差Claisen縮合、分子内交差Claisen縮合等について講義する(26章) 習到達度の確認,1回,講義を行った22章から26章の学習到達度を確認する。 繁・講義についての解説,1回,有機化学全般の理解について到達度を上げる。 20urse requirements] 確有機化学1,基礎有機化学II,有機化学I (先端化学),有機化学II (先端化学)の講義内容 Evaluation methods and policy] 期試験(85%)、平常点評価(15%) Textbooks] rganic Chemistry Second Edition (J. Clayden, N. Greeves, S. Warren, Oxford University Press, 2012) ISBN 9780199270293 References, etc.] (Reference books) 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	Course title (and course title in English) mage: Course title (and course (by: Course Course) Graduate School of Engineering Associate Professor, SUGASE K Graduate School of Engineering Associate Professor, SUGASE K Graduate School of Engineering Associate Professor, UMEYAMA TOMOL Graduate School of Engineering Senior Lecturer/HGASHIGUCHI K Target year ad year students or abov Number of credits 2 Year/semesters 2021/Second seme 2021/Second seme Days and periods Tue.1 Class style Lecture impage/instude Japanese IOverview and purpose of the course] In this subject, students are taught the fundamentals of spectroscopy, molecular structure, rotational and vibrational spectra, electronic transitions and photochemistry, magnetic resonance, and statistical thermodynamics. ICourse objectives] The aim is to learn basic concepts of spectroscopy as a whole and statistical thermodynamics. ICourse schedule and contents] Basics of spectroscopy, 1 session What is spectroscopy, 1 session Rotational and vibrational spectra, vibrational energy levels and spectra, lasers, symmetry and normal vibration, Raman spectrum Electronic transitions and photochemistry, 2 sessions Electron basic concept spin reisplace, fluorescence and phosphorescence, photochemical cha reactions, photolysis, photosynthesis Magnetic resonance, 2 sessions Magnetic resonance, 2 sessions Magnetic properties of molecule

物理化学Ⅲ(先端化学)(2)	Course number
[Course requirements] It is assumed that students have already taken "Physical Chemistry: Fundamentals and Exercises," " Physical Chemistry I," and "Physical Chemistry II."	Course title (and course title in Introduction to Polymer Chemistry) II (社站aced Chemistry) and department introduction to Polymer Chemistry II (社站aced Chemistry)
[Evaluation methods and policy]	English) of affiliation Institute for Chemical Research
Evaluation is mainly based on results from regular examinations, and, to a lesser degree, attendance in lectures and submission of reports. Attendance, short tests, and assignment reports are all subject to evaluation. Marks are given if these evaluation items are only partially satisfied.	Assistant Professor,SHIZU KATSUYUKI Institute for Chemical Research Assistant Professor,SUZUKI KATSUAKI
[Textbooks]	Target year Brd year students or above Number of credits 2 Year/semesters 2021/Second semester
Atkins, P., Paula, J. (translated by Nakano, M., Ueda, T., Okumura, M., and Kitagawa, Y.), Atkins butsuri kagaku (ge) dai 10-pan, (Tokyo Kagaku Dojin, 2017) ISBN:978-4-8079-0909-4	Days and periods Wed.2 Class style Lecture Lingupt distution Japanese [Overview and purpose of the course] 高分子が示す特徴的な構造(たとえば結晶と非晶)と特徴的な物性(たとえば粘弾性)は、高分子 (たんしの) (たんしの)
[References, etc.]	鎖が長い糸状の構造を持つことに起因する.この視点に基づき、高分子の溶液、融液および固体状態における構造と物性について説明を行う.
(Reference books) Moore, W.J. (translated by Fujishiro, R.), Moore butsuri kagaku (jou) oyobi (ge) dai 4-pan, (Tokyo Kagaku Dojin, 1974) ISBN:978-4-8079-0002-2	[Course objectives] 高分子の構造と動的挙動、物性の関連を分子描像に基づいて理解することを求める。
[Study outside of class (preparation and review)]	[Course schedule and contents]
Since the subject is taught under the assumption that students have basic knowledge on quantum chemistry, students must thoroughly review the basics of quantum chemistry in advance.	- 高分子鎖の形と広がり,2回: 線状高分子について、分子特性の基本となる高分子鎖の形の分布と広 がりを説明する.
(Other information (office hours, etc.))	溶液の性質,3回: Flory-Hugginsの理論に基づき、混合エントロピー、混合エンタルピーおよび化学 ポテンシャルの誘導について述べ、この結果を基に、浸透圧や相平衡などの熱力学的性質を説明す
Note: If a student has already completed "Physical Chemistry III (Basic Industrial Chemistry)" and earns credits for "Physical Chemistry III (Advanced Chemistry)," these will be treated as additional credits.	る.また、分子量などの基本的な分子特性の決定法についても説明する. 固体の構造.2回:長い高分子鎖が、結晶化条件により単結晶、球晶、ラメラ晶、伸び切り鎖結晶な
*Please visit KULASIS to find out about office hours.	どを形成することを示し、基本的な結晶化過程について説明する.また、このような結晶化試料の 結晶・非晶構造の解析法と解析結果について説明する.
[Courses delivered by instructors with practical work experience]	ガラス転移,1回:高分子が示す熱運動について概説し、主鎖の熱運動の凍結に伴うガラス転移現象 について述べる.さらに、ガラス転移に伴う力学的性質と熱的性質の変化、および、その分子機構
 Category A course with practical content delivered by instructors with practical work experience 	について説明する。 ゴム弾性,2回:ガラス転移点以上のゴム中で屈曲性高分子鎖が示すコンホーメーション分布につい て説明し、エントロビー弾性としてのゴム弾性がいかにして発現するかについて鎖の熟運動に主眼
(2) Details of instructors' practical work experience related to the course	を置いて解説する。また、弾性率の分子論的表記についても説明する。 高分子ダイナミクス4回・屈曲性高分子鎖の落臓系が示す粘弾性を鎖の運動(ダイナミクス)と対応付けて説明し、鎖同士が互いに横切れないために生じる絡み合い効果について述べる。さらに、
(3) Details of practical classes delivered based on instructors' practical work experience	(A型高分子)についての現在の分子理論についても構造し、主鎖骨格に平行な双極子を持つ、 第00運動と粘弾性についての現在の分子理論についても構造し、主鎖骨格に平行な双極子を持つ、 分子(A型高分子)については、長時間域の誘電緩和と粘弾性緩和の対応についても説明する。 学習到達度の確認、回:本講義内容全体について要点をまとめて各項目間の関連を概説し、試験などで理解不足が確認される項目に対する学習到達度を高める。
高分子化学概論II(先端化学) (2)	Course number
[Course requirements] 3 年前期配当の「高分子化学概論I」を履修していることが望ましい.	Course title (and course title in English) English)
[Evaluation methods and policy]	
原則として、講義時間内に行う試験と、レポートで成績評価します。 ただし、コロナの状況によっては、試験を行わず、講義後の課題提出で 成績を付けます。	Target year 4th year students or above Number of credits 2 Year/semesters 2021/First semester Days and periods Mon.2 Class style Lecture Laquage distudent Japanese

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[Textbooks] 随時、プリントを配布

[References, etc.]

(Reference books) 「新高分子化学序論」(化学同人) isbn { } {4759802584 } 「高分子の構造と物性」(講談社)ISBN 978-4-06-154380-5 isbn { } {9784061543805 }

[Study outside of class (preparation and review)] 高分子の挙動を記述するためには、熱力学と統計力学が必要となる。 このため、熱力学と統計力学(の初歩)について十分な復習を行っていることが必要である。

(Other information (office hours, etc.))

【注意:「高分子化学概論Ⅱ(工業基礎化学)」を、すでに単位修得した学生が「高分子化学概論Ⅱ 先端化学)」を履修し単位修得した場合、増加単位となる。

*Please visit KULASIS to find out about office hours.

化学統計力学(先端化学)(2) 化学統計力学(先端化学)(3) 2)アンサンブルの考え方の会得3)物質の物理的な性質に関する統計力学的な理解 [Course requirements] (3) 物質の物理的な性質に関する統計力学的な埋解 4) 古典統計力学から量子統計力学への発展 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、化学反応動力学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。 物理化学基礎及び演習,物理化学 Ⅰ- Ⅲ〔先端化学〕の履修を前提とする。 [Evaluation methods and policy] 授業回ごとのQuestion Paper/Quizにて評価する。定期試験は実施しない。100点満点 Making your scores based on Question Papers/Quiz in classes. No final exam is scheduled. Maximum scores Targets 1) Definition of entropy by statistical mechanics and understanding the concepts of entropy via mathematical 100 rivation [Textbooks] 2) Concepts of ensembles 3) Physical properties of matters in view of statistical mechanics 持になし 4) From classical statistical mechanics to quantum statistical mechanics Finally we approach to the limitations of the classical statistical mechanics, leading to the dawn of quantum [References, etc.] 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-(Reference books) (Reference books) ムーア「物理化学 [上]」第4版,藤代亮一訳(東京化学同人)isbn{}{4807900021}; アトキンス「物理化学 (下)」第8版,千原秀昭,中村恒男訳(東京化学同人)isbn{}{ Boltzmann systems and Fermi-Dirac/Bose-Einstein statistical systems. 9784807906963} 978407909937; マッカーリ・サイモン「物理化学-分子論的アプローチ(下)」, 千原秀昭, 江口太郎, 斎藤一弥 訳(東京化学同人)isbn{} [9784807905096} 久保亮伍 「統計力学」(共立出版)isbn{} [9784320034235} [Course schedule and contents] [Course schedule and contents] 1. 統計力学の基礎, 1回 2. 「確率と統計」の考え方の整理,分布という考え方, 1回 3. ランダムウォーク,ブラウン運動,拡散方程式,状態数, 1回 4. 気体分子運動論, 1回 5. 統計力学におけるエントロピー,1回 6. 確からしい配置,統計力学的エントロピー, 分配関数と熱力学量の導出,3回 7. 小正準アンサンブルと小正準分布,2回 8. 大正準アンサンブルと大正準分布,2回 9. ボルツマン分布,7 エルミ・ディラック分布,ボース・アインシュタイン分布 10. 自発的な対称性の破れと物質の性質,2回 11. 統計力学の応用と学習到達度の確認,1回,本講義の内容に関する理解度の確認をする。 [Study outside of class (preparation and review)] 受業中に指示する (Other information (office hours, etc.)) 月曜日 17-18時 Monday, 17:00-18:00 注意: 「化学統計力学(工業基礎化学)」を、すでに単位修得した学生が「化学統計力学(先端化 学)」を履修し単位修得した場合、増加単位となる。 *Please visit KULASIS to find out about office hours Fundamentals of Statistical Mechanics Probability and Statistics: Leading distributions Random walk theory and Brownian motion, in relation to diffusion equation Movement of particles, in gas phase Entropy derived from statistical mechanics: Boltzmann entropy Probable configuration, intensive/extensive variables and partition function 6. Provac. 7. Ensembles . Grand canonical ensembles and distributions 9. Fermi-Dirac and Bose-Einstein distribution 10. Spontaneous symmetry breaking in the systems 10. spontanceus symmetry 11. Discussions Continue to 化学統計力学(先端化学)(3)↓↓↓

(and course 先達 title in Front English)	出機器分析科 iers in Instrumental Ar	学(先端化学) malytical Science (Advanced Chemistry) and department of affiliation					
Target year	4th year students	or above Number	of credits	2	Year	/semesters	2021/First semester
Days and periods	Wed.2	Class style	Lecture			Language of instruction	Japanese
いるために、 考 なくなっている ま く な き 間 分 野 を 構 線 分 析 、 液 体 ク 多 そ で の て い る る で 、 き で の て い る る れ く 、 き で の む で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 で 。 る る る 、 さ で う た る る 、 な 、 ぎ 間 分 野 を 校 長 の 野 を 校 様 線 分 析 、 液 体 ク う 、 液 体 ク う … た 本 う 。 。 、 で し る る る 、 で か ら 。 る 、 液 か ら 、 液 か ら 、 で か ら 。 、 、 で か ら 。 、 で ら 。 の 一 た も う の 一 た も う 。 の 一 た も う の 一 た も う 。 の か た ち ら 。 の 、 液 体 ク う 。 。 。 、 で ら 。 。 の 、 で ら 。 の 、 、 で ん ら っ 。 の 、 で ら 。 の 、 で ん ら っ 。 の っ ら 。 の っ ら 。 の っ ら 。 、 、 の ち の っ ら 。 う 、 っ っ ら っ ら ら 。 う ら っ っ ら っ っ っ っ っ っ っ っ っ っ っ っ っ	その「利用」 5。しかし、 5。今日では 日みそのもの 豊器分析科学 クロマトグラ ctives]	においては、必 得られたデータで 、化学の分野バー と定義し、その フィーおよび電	ずしも「約 の解釈や阿 で使用される する範囲を 先端、進 切 気分析化 弓	首の中身 見界を析 会なな た を し し	」を起これに講て、	里解しなくて のには、そ の た で し る。 こ の 形 式 で 講 勤 か な 研 外 に り る 。 さ こ ろ 様 こ の の 。 さ 、 ろ 様 こ の の 。 で が う に い る 。 こ の る 。 こ の る 。 こ の る 。 こ の こ 。 る に う る 。 こ の こ 。 こ で が こ っ こ 。 こ 、 ろ で い こ る こ 。 こ 、 ろ ば 、 ろ に う こ 。 こ こ つ に 、 ろ ば に う こ 。 こ こ つ に 、 づ に う に 、 こ こ こ こ っ こ 、 こ こ つ に 、 つ に 、 づ に う に 、 こ こ こ つ に 、 こ こ こ こ こ こ こ こ こ こ こ こ こ	スが大きく進歩して も可能であることが 動作原理を把握して なり、その分析の原 の講義ではこのよう する。本年度は、X 成果を含む内容の講 て、その基本原理か
ら理解し、応用 [Course sche 先端機器分析 失端機器分析	dule and co 所科学入門,11	ntents]	講義の目的	白、性格	、成績	遺評価等に関	11
高機能充填剤		分析への応用,4					
高機能充填着 液体クロマトク 高性能充填剤に 用されている。 で、生体試料の アフィニティー 高機能充填剤の	ブラフィー (L には、高分離 しかし、高 の直接注入の -を利用した)特性とその	.C)の今日の発展 能充填剤および 分離能充填剤が ための浸透制限 分子インプリン	は、高性能 高機能充均 種々の対象 型充填剤、 ト充填剤な について	真剤があ 泉物質の 光の高 に述べる	る。 合析 化 代 代 に 1	前者は、高速 こ万能である 合物の分離の 充填剤が開発 . 浸透制限型	ろが大きい。LC用 ・高分解能分離に適 とは言い難い。そこ ためのキラル充填剤、 されている。これら 型充填剤 2.キラル

先端機器分析科学(先端化学)(2)

解析例について、最近の研究成果を交えて解説する。

pH計測の基礎と応用,6回

pH計測の基礎と応用,6回 pH は、いうまでもなく非常に重要な酸性度の指標である。pHメータで、簡易に測定できるもので あるが、実際には信頼できる値を得ることは難しいことも多い。その理由は、技術的問題にとどま らない。水素イオンの活量。{H++1の対数、pH = -log_{10}a_{1}(++) として定義される pH の測定 は、単独イオンの活量を熱力学的な確かさ7週ごすることは出来ないという、原理的・本質的な難 しさがある。 単独イオン活量の可測性の問題は、電気化学の根本問題でもある。ここでは、pHメ ータの原理やガラス電極の作用機作などのpH 測定の技術的な側面だけでなく、このもっともあり ふれた日常的な測定置である pH の本質的な考え方の枠和低を述べ、それを踏まえてとらえ直す酸性 雨や海洋の酸性化に関する諸問題の解決の方向性を視野に入れた講義を行う。

[Course requirements]

分析化学、物理化学の基礎的事項を習得していることが望ましい

[Evaluation methods and policy] 講義に参加した上で提出されたレポート内容に基づいて評価する。

[Textbooks]

特に指定しない

[References, etc.] (Reference books)

レポート課題に対応すること (Other information (office hours, etc.))

注意:「先端機器分析科学(工業基礎化学)」をすでに単位((先端化学)」を履修し単位修得した場合、増加単位となる。 をすでに単位修得した学生が、「先端機器分析科学 注音 :

*Please visit KULASIS to find out about office hours

[Study outside of class (preparation and review)]

Course number	有機化学Ⅳ(先端化学)(2)
Course title Instructor's Graduate School of Engineering	[References, etc.]
and course 有機化学IV(先端化学) Organic Chemistry IV (Advanced Chemistry) and department of affiliation of affiliation of affiliation	(Reference books)
Associate Professol, PAOARI AIICHIROC	
Farget year 4th year students or above Number of credits 2 Year/semesters 2021/First semester	[Study outside of class (preparation and review)]
Days and periods Fri.2 Class style Lecture Language distution Japanese	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).
[Overview and purpose of the course]	
in the class, stereoselective and stereospecific reactions of cyclic and non-cyclic compounds as well as	(Other information (office hours, etc.))
nonionic transformations, such as pericyclic reactions, rearrangement, and radical reactions, are explained.	Better to bring the textbook. *Please visit KULASIS to find out about office hours.
[Course objectives]	*Please visit KULASIS to find out about office hours.
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]	
t is desirable for students to take classes of Organic Chemistry I, II, & III (Fundamental Chemistry) before his class.	
[Evaluation methods and policy]	
Evaluation will be based on examinations (80%) and class performance includes attendance and short reports 20%).	
[Textbooks]	
Nick Greeves, Stuart Warren, Peter Wothers, Jonathan Clayden 『Organic Chemistry 2nd Edition』 (Dxford University Press) ISBN:978-0-199-27029-3	
Continue to 有機化学Ⅳ(先端化学)(2)↓↓↓	

Course n	umbor										
Course number Course title (and course title in English) 大端化学実験I(先端化学) Advanced Chemistry Laboratory I(Advanced Chemi					Chemistry)	name and d	uctor's , job tit lepartm iliation	nent	Graduate School of Engineering Professor,OGOSHI TOMOKI Faculty of Engineering Professor,		
arget year Sind year students or above Number of credits 7 Year/semesters 2021/First semester									2021/First semester		
Days and peri	ods Tue3,4,5,	Wed.3,4,5,Thu.3,4,5	Class s	tyle	Experi	ment			Language of instruction	Japanese	
	ミ験第一 ミ験)、	(実験基礎 第四(無様	濋)を 聶	最初に履						担化学実験)、第三(うち指示された実験を	
特別研究に		-	験技術な	ょらびに	報告書	作成	方法を	身に	つける。		
[Course s	chedu	e and co	ntents]								
である。本 ス器具、電	、溶液系 実験の 子はか	での定量 目的は、 り、測容	物質の5 器などの	2量的な)取扱い	取扱い 法、な	方法。 らびし	と測定 こ溶解	の基準	本的な考え方 殺生成、濾過	る重量分析と容量分析 方の理解にあり、ガラ 過、恒量操作、測容、 が廃液処理についても	
先端化学実 熱力学、反			理論们	之学計算	、材料	化学	こ関す	る実際	鹸を行う。		
	ついて	習得し、I							Grignard反応 高分子合成等	ふ、Wittig反応、Diels- 実験を行う。	
1. 金属錯 塩のイオン	おける 体の合 _反 /伝導と	, 基本的概:	バトクロ の相関	ミズム 4. 粉۶	2. イ: たX線回	オン? 回折に	交換膜 よる約	・ ポ 詰晶構	リマー膜の腫 造解析及び	04項目の実験を行う。 賃電位 3. オキソ酸 電気化学的エネルギ 56版)を参考書とし	
先端化学実 細胞の形質			析ならて	ドに酵素	反応の	特性。	とその	利用(こ関する実験	食を行う。	
								_c	ontinue to 先端		

	ments]
工業化学科2年生ま	までの配当専門科目を理解していることを強く望む。
[Evaluation mether	hods and policy]
<評価方法> ・実験第一	
	、レポート(50%)
平常点には、実習	への参加状況を含む。
・実験第二	、レポート(57%)、プレゼンテーション(5%)
	、レホート(57~)、ノレセンケーション(5~) への参加状況を含む。
・実験第三	
	への参加状況・受講状況・実験ノートの記述チェックを含む。また、原則として てのレポートを提出した場合にのみ与える。
・実験第四	
平常点には, 美智 ・実験第五	・講義・講評への参加状況を含む。
	、レポート (42%)
平常点には、実験	前の講義・実習への参加状況を含む。
<評価方針>	
	の評価点(100点満点)を平均化総合評価とする。ただし、実験第四および実
	重率はそれぞれ、11/18、7/18とする。ただし一つでも不合格(60点
木満)であれば、	全体として不合格とする。
[Textbooks]	
先端化学コース実	験テキスト(先端化学コース関連教員 著)を配布し、それを使用する。
[References, etc	.]
(Reference bo	
必要であれば適宜	指示する。
Chudu autaida a	f along (managedian and review)]
[Study outside o 授業中に指示する	f class (preparation and review)]
1又未中に1日小りつ	
	ion (office hours, etc.))
	るための前段階であるので、実験第1~5の全ての実験に合格せねばならない。
特別研究に着手す	
特別研究に着手す 不合格になった実	験のみ次年度に再履修できる。指定されたクラスで受講すること。 詳細については、KULASISで確認してください。
特別研究に着手す 不合格になった実 オフィスアワーの 注意:「工業基礎	験のみ次年度に再履修できる。指定されたクラスで受講すること。 詳細については、KULASISで確認してください。 化学実験 I 」を、すでに単位修得した学生が「先端化学実験 I 」を履修し単位修
特別研究に着手す 不合格になった実 オフィスアワーの	験のみ次年度に再履修できる。指定されたクラスで受講すること。 詳細については、KULASISで確認してください。 化学実験 I 」を、すでに単位修得した学生が「先端化学実験 I 」を履修し単位修

Course number			先端化学実験II(先端化学)(2)	
(and course 先端化学実験II(先端化学) title in Advanced Chemistry Laboratory II(Advanced Chemistry) 年	name, job title, Profe	ate School of Engineering ssor,OGOSHI TOMOKI ty of Engineering ssor,	レポート評点は全てのレポートを提出した場合にの ・実験第四 平常点(40%)、レポート(60%) 平常点には、実習・講義・講評への参加状況を含む	
Target year Brd year students or above Number of credit	ts 7 Year/seme	2021/Second semester	 ・実験第五 平常点(58%)、レポート(42%) 平常点には、実験前の講義・実習への参加状況を含 	>#0
Days and periods[1ue3,4,5,Wed3,4,5,Thu3,4,3Class style Experim	nent Larguage	of instruction Japanese	<評価方針>	0.0
[Overview and purpose of the course] 先端化学実験第二(物理化学実験)、第三(有機化 五(生物化学実験)のうち指示された実験を履修す		機化学実験)、ならびに第	▲「町町の」」 実験第二~第五のの評価点(100点満点)を平均 験第五の評価点の重率はそれぞれ、11/18、7 未満)であれば、全体として不合格とする。	
[Course objectives] 特別研究に必須である,実験技術ならびに報告書作	斥成方法を身につける	0	[Textbooks] 先端化学コース実験テキスト(先端化学コース関連	[教員 著)
[Course schedule and contents]				
先端化学実験第二,18回 熱力学、反応速度、分光学、理論化学計算、材料化	と 学に 関する 実験を 行	-ð.	[References, etc.]	
先端化学実験第三,18回 蒸留操作について習得し、Diels-Alder反応、Beckm ルボニル基の還元反応、Grignard反応に関する実験			必要であれば適宜指示する。 	01
先端化学実験第四,11回 無機化学における基本的概念を実験を通して習得す 1. 金属錯体の合成とソルバトクロミズム 2. イオ 塩のイオン伝導と結晶構造の相関 4. 粉末X線回: 一変換 全体を通じて、無機化学(上・下)(ショ て用いる。	することを目的として †ン交換膜・ポリマ− 折による結晶構造解り	、次の4項目の実験を行う。 膜の膜電位 3. オキソ酸 所及び電気化学的エネルギ	授業中に指示する (Other information (office hours, etc.)) 特別研究に着手するための前段階であるので、実験 不合格になった実験のみ次年度に再履修できる。指 オフィスアワーの詳細については、KULASISで確認)	定されたク 忍してくださ
先端化学実験第五,7回 細胞の形質転換と遺伝子解析ならびに酵素反応の特	寺性とその利用に関す	る実験を行う。	注意:「工業基礎化学実験Ⅱ」を、すでに単位修得 得した場合、増加単位となる。	した学生が
[Course requirements]			*Please visit KULASIS to find out about office hours.	
工業化学科2年生までの配当専門科目を理解してい	ることを強く望む。			
[Evaluation methods and policy]				
《評価方法》 ・実験第二 平常点(38%)、レポート(57%)、プレゼン 平常点には、実習への参加状況を含む。 ・実験第三 平常点(60%)、レポート(30%)、試験(1 平常点には、実習への参加状況・受講状況・実験/	10%)	を含む。また、原則として		
	Continue	- to 先端化学実験II(先端化学)(2)↓↓↓		

	↓0%)、レポート(60%) は、実習・講義・講評への参加状況を含む。
 実験第五 工営占(5) 	ī 58%)、レポート(42%)
	は、実験前の講義・実習への参加状況を含む。
<評価方針	
験第五の評	- 第五のの評価点(100点満点)を平均化総合評価とする。ただし、実験第四および F価点の重率はそれぞれ、11/18、7/18とする。 ただし一つでも不合格(60 られば、全体として不合格とする。
Textbook	[8]
-	コース実験テキスト(先端化学コース関連教員 著)を配布し、それを使用する。
[Referenc	tes etc.]
-	nce books)
必要であれ	ば適宜指示する。
[Study ou	Itside of class (preparation and review)]
授業中に指	示する
(Other in	formation (office hours, etc.)
不合格にな	Ξ着手するための前段階であるので、実験第1~5の全ての実験に合格せねばならない ⊳った実験のみ次年度に再履修できる。指定されたクラスで受講すること。 '7−の詳細については、KULASISで確認してください。
	- 業基礎化学実験Ⅱ」を、すでに単位修得した学生が「先端化学実験Ⅱ」を履修し単位 ↑、増加単位となる。
*Please visi	it KULASIS to find out about office hours.

生命化学基礎(先端化学)(2)

[Textbooks] 毎回プリントを配布する。

[References, etc.]

(Reference books)
 ・工学系のための生化学 化学同人(ISBN: 9784759814644)
 ・カラー図解 アメリカ版 大学生物学の教科書 第1-3巻 ブルーバックス (ISBN:9784062576727, ISBN:9784062576734, ISBN:9784062576734)

[Study outside of class (preparation and review)] 各授業内容についての課題をレポートにまとめて提出する。

(Other information (office hours, etc.)) 注意:「生命化学基礎(工業基礎化学)」を、すでに単位修得した学生が「生命化学基礎 I (先端 化学)」を履修し単位修得した場合、増加単位となる。

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

Course nu	umber									
Course title (and course title in English) Chemical Basis of Life(Advanced 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 Professor, HAMACHI ITARU Graduate School of Engineering Senior Lecturer, TAMURA TOMONOI		
Target yea	Target year 2nd year students or above Number of credits 2 Year/semesters 2021/Second								2021/Second semester	
Days and perio			ss style	Lectur	e			Language of instruction	Japanese	
[Overview	i and pι	urpose of th	e course]							
として巧妙 立場でとら	生きているとはどういうことであろうか。生命活動は、数万種類の化学反応系が集積し、システム として巧妙に制御されることにより営まれている。この講義では、生きているという状態を化学の 立場でとらえるための基礎的な知識を解説する。さらに、生命現象の秘密がどのように解き明かさ れ、現代社会の中で利用されているのか、生命化学の最先端の状況についても解説する。									
-	•	55] 立場で理解す	るための基	本的な	概念	と原理	、物	質的基盤を修	8得できる。	
ICourse s	chedul	and conte	ntsl							
ど生物支 生命や特子と造 遺生酵料とと し のの に 、 素 謝 る 体 る 習 当 達 を 物 で た 、 素 謝 る 体 ろ 当 達 の の 伝 、 素 謝 る を 体 う と 道 の の の の の の の の の の の の の の の の の の	生体分子の働き,1回,血液凝固、免疫応答、神経活動、発生と分化、臓器の機能と疾患について解説									
[Course re	· ·	nents]								
特に必要と	しない									
平常点評価 平常点評価	i(40%) iには、i	ods and po レポート 授業への参加 、工学部の成	(60%) 1状況や小テ							
				·		·		Continue to 生命	化学基礎(先端化学)(2)↓↓↓	

Course nu	mber								無
	無機化学III(Inorganic Chemis			na nemistry) an	structor's me, job ti d departr affiliatior	tle, nent 1	Professor,KA Graduate Sc Associate Pro Institute for Professor,M Graduate Sc	hool of Engineering AGEYAMA HIROSHI hool of Energy Science fessor,TAKAI SHIGEOMI Chemical Research IZUOCHI NORIKAZU hool of Engineering er,MUROYAMA HIROKI	of o Ele Ma the
Farget year	r 3rd year studen	s or above	Number	of credits	2	Year	/semesters	2021/Second semester	Cor Stu
Days and perio	ds Fri.1	Class	s style	Lecture			Language of instruction	Japanese	[C
[Overview	and purpose	of the	course]						No
					etween s	yntheti	ic methods, s	tructures, and physical	TE
properties of	inorganic solid	s using c	oncrete ex	ampies.					Stu
[Course of	<i>·</i> ·								per
								id-state synthetic	π
								crystallography and non - stoichiometry,	Oth
	nical bonds of s		1	<i>e</i> ,		-,		<i></i>	978
									Or
[Course of	chodulo and d	ontort	e1						
-	chedule and c		•						We
- Solid-state sy	ynthetic method	s, 2 sess	ions	inorganic s	olids th	ough s	olid-phase, li	iquid -phase, and gas-	We
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Solid-state sy Students are phase synthe	ynthetic method given an explar	s, 2 sess ation on ge, elect	ions obtaining						We
Solid-state sy Students are phase synthe hydrotherma Solid-state cl	ynthetic method given an explar ses, ion exchan l method, and s haracterization,	s, 2 sess ation on ge, elect o forth. 2 session	obtaining obtaining rochemica	l reactions,	thin film	ı, prepa	uration of mo	nocrystals, the	We
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Course nu	umber							未更新
Course title (and course title in English)		学Ia(先端化: Chemistry Ia (A		na emistry) an	structor's ime, job ti id departn affiliation	tle, nent	Associate Profes Center for the Promotion	nool of Engineering sor,TERAMURA KENTARC of Interdisciplinary Education and Research nior Lecturer,ASAKURA HIROYUK
Target yea	r 2nd y	ear students or abov	Number	of credits	2	Year/	semesters	2021/Second semester
Days and peri	ods Wed.	2 Clas	s style	Lecture			Language of instruction	Japanese
[Overview	and pu	rpose of the	e course]					
		asic contents i cal reactions.	elated to the	rmodynam	nics and o	hemica	al kinetics, w	hich are necessary for
[Course o	bjective	s]						
- Through this	s subject,	which contin ssary abilities						
[Course s	chedule	and conter	its]					
lectures is n	ot fixed; backgroun 3 session:	rather it is pro nd and underst s]	perly determ anding. libriums, the	nined by the	e lecture	based	on their poli	sub-item is taught in cy, as well as on
The concept (2) Thermoo Partial mola (3) Chemica Dynamic eq (4) Chemica Chemical re complex the (5) Confirm (6) Feedbac	lynamics r quantity 1 equilibrium 1 kinetics action rat ory, chai ation of 1 c [1 sessi	of solutions [7, activity, osn riums [3 sessions] te, rate equation n reactions, car earning achieve on]	notic pressur ons] ee enthalpy, on, rate cons talytic react	equilibriun tant and eq ions	ns of non	-ideal s	systems, fuga	city theory, activated-
The concept 2) Thermoo Partial mola 3) Chemica 3) Chemica 3) Chemica 4) Chemica 7 4) Chemica 7 5) Confirm 6) Feedbac [Course ro Students are	lynamics r quantity l equilibrium l kinetics action rationy, chai ation of l c [1 sessi equirem required	of solutions [, activity, osn iums [3 sessi s, standard fre [5 sessions] te, rate equation n reactions, cz earning achiev on] ents]	notic pressur ons] ee enthalpy, on, rate cons italytic react red [1 sessio	equilibriun tant and eq ions n]	ns of non uilibriun	-ideal s	systems, fuga	

(先端化学)(2)

at exist in crystals are explained in relation to the physical properties of solids.

perties, 2 sessions h as metallic conductors, superconductors, semiconductors, and ionic conductors, along with al properties, are explained.

n of learning achieved, 1 session nderstanding of lecture contents is confirmed.

quirements]

n methods and policy] evaluated out of 100 marks based on their result on the end-of-term examination (80%) and their in teaching sessions (attendance status and reports, etc.) (20%).

s]

;, A.R., Solid State Chemistry and its Applications, 2nd Edition, (Wiley, 2014) ISBN: 948

ted version Uesuto kotaikagaku kiso to ouyou (KS kagaku senmonsho) ISBN: 9784061543904

es, etc.]

ce books)

side of class (preparation and review)]

t read through the applicable chapter before attending each teaching session. Generally, students to submit assignments weekly.

ormation (office hours, etc.))

ident has already completed "Inorganic Chemistry III (Basic Industrial Chemistry)" and ea 'Inorganic Chemistry III (Advanced Chemistry)," these will be treated as additional credits. and earns

KULASIS to find out about office hours.

物理化学la(先端化学)(2)

[Evaluation methods and policy]

nation is based on either regular examinations only (100 marks), or performance in teaching sessions (50 Eval marks) and regular examinations (50 marks). However, performance in leaching sessions encompasses the mid-term examination, as well as tasks such as preparing for and reviewing lectures. Obtaining at least 60 out of 100 marks is considered passing, while 59 or below is considered a fail.

[Textbooks]

Not used

[References, etc.]

[References, euc.] (References, euc.] Moore, W.J. (translated by Fujishiro, R.), Mooa butsuri kagaku (ue) dai 4-ban, (Tokyo Kagaku Dojin, 1974) ISBN: ISBN4-8079-0002-1 (Chapters 6, 7, 8 and 9); Atkins, P., Paula, J. (translated by Nakano, M., Ueda, T., Okumura, M., and Kitagawa, Y.), Atokinsu butsuri kagaku (ue) dai 10-ban, (Tokyo Kagaku Dojin, 2017) ISBN:ISBN978-4-8079-0908-7 (Chapters 4, 5 and 6); Atkins, P., Paula, J. (translated by Nakano, M., Ueda, T., Okumura, M., and Kitagawa, Y.), Atokinsu butsuri kagaku (shita) dai 10-ban, (Tokyo Kagaku Dojin, 2017) ISBN:ISBN978-4-8079-0909-4 (Chapters 20 and 21)

[Study outside of class (preparation and review)]

Students must review contents covered in lectures before taking the end-of-term examination

(Other information (office hours, etc.))

Note: If a student has already completed and earned credits from "Physical Chemistry I (Basic Industrial Chemistry)" or "Physical Chemistry Ia (Basic Industrial Chemistry)" and earns credits for "Physical Chemistry Ia (Advanced Chemistry)," these will be treated as additional credits. * For details on office hours, please check KULASIS.

Course number	物理化学Ib(先端化学)(2)
Course title (and course Hub in English) 你理化学Ib (先端化学) (先端化学) Instructor's name, job title, and department of affiliation Graduate School of Engineering Professor,Shu Seki Institute for Chemical Research Professor,WATANABE HIROSHI Institute for Chemical Research Assistant Professor,SATO TAKESHI	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
Target year Ind year students or above Number of credits 2 Year/semesters 2021/Second semester Days and periods Thu. 2 Class style Lecture Language distudito Japanese	the feasibility of statistical mechanics for understanding the physical properties of matters/chemical reactions.
Days and periods Thu.2 Class style Lecture angue distant Japanese [Overview and purpose of the course] ************************************	[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) エントロビ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。
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。	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
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	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
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	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.
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.	[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:熱力学等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
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b (先端化学) (2)↓↓↓	第7回:カノニカルアンサンブルと分配関数 Continue to 物理化学Ib(先端化学)(3)↓↓↓
物理化学Ib(先端化学)(3)	物理化学Ib(先端化学)(4)
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:弾性とエントロビー 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:活性錯合体理論と絶対反応速度論 第14回:活性指合体理論とと解決	[Textbooks] ムーア 『物理化学(上)』(東京化学同人)ISBN:978-4807900022 [References, etc.] (Reference books)
Principles of Statistical Mechanics and Entropy; mathematical backgrounds Definition of Entropy: Approaches from statistical mechanics and conventional thermodynamics Boltzmann Principles: Historical reviews starting from the discussions by Clausius A Translational Motion of Atoms/Molecules	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 Voll』ISBN:978-0465024933 田崎晴明 『統計力学I』(培風館)ISBN:978-4563024376
Trainational Motion of Advision Advisor Advisora Advisor Advisor Advisor Advisor Advisor Advisor Advisor Advisor	[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。
10. Entropy Elasticity 11. Brownian Motions and the Collision Theory of Particles 12. Arrhenius Equation and Law	Think quantitatively and calculate anything. (Other information (office hours, etc.))
 Eyring Equations and the Transition State Theory Limitations of Classical Statistical Mechanics towards Quantum Statistical Mechanics Statistical Mechanics Applications including Exercise 	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
[Course requirements] None	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
[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。	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)」もしくは「物理化学 I b (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 I b (先端化学)」を履修し単位修得した場合、増加単位となる。
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	※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。
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。	*Please visit KULASIS to find out about office hours.
※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)	
 Active participation + midterm examination + final examination in total Final examination only 	
No makeup exam after the final examination.	
Continue to 釉ư化学ID (先端化学)(4)↓↓↓	

Course number		科学英語(先端化学)(2)
	Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering e. job title, Professor,SHIRAKAWA MASAHIRO	[Evaluation methods and policy] 定期的な簡単なレポート
tle in Scientific English and	department Graduate School of Engineering filiation Associate Professor,MIKI KOUJI	[Textbooks]
arget year Brd year students or above Number of credits	Part-time Lecturer,Scott,Joseph Walker 2 Year/semesters 2021/Second semester	特に指定しない
ays and periods Mon.3 Class style Lecture	2 Year/semesters 2021/Second semester	[References, etc.] (Reference books)
Overview and purpose of the course] と学を中心とした科学・工学の英語論文・発表から考		なし
ユチを中心とした科チ・ユチの英語論文・現表から考 見・伝達ができるようになるための、実践英語の基礎		[Study outside of class (preparation and review)] 教員が配布するプリントで予習復習を行うこと
Course objectives] 国際的に活躍できるために必要な、実践英語力習得の		(Other information (office hours, etc.))
て、英語で物事の背景、疑問、研究調査の目的・手法 唇で表現できるようになる。	・結果・考察、今後の展開などを論理的に英	学生の要望に応じて開講 講義に支障をきたす大人数になった場合、抽選等で適正人数にする場合があります。
[Course schedule and contents]		注意:「科学英語(工業基礎化学)」を、すでに単位修得した学生が「科学英語(先端化学)」 履修し単位修得した場合、増加単位となる。
本科目では講義形式の授業のほか、ワークショップ形 生が数グループに分かれて実際に論文の独解ならびに	式の演習も行う。ワークショップでは、受講 作成を行う。Native Speakerの英語にも触れて	*Please visit KULASIS to find out about office hours.
もらう。 回		[Courses delivered by instructors with practical work experience]
ー 化学分野を中心とした英語で書かれた科学論文・記事	の読解と表現方法の解説をする。	 Category An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.
4回, テクニカルライティング。英語論文を書く上で重要な ンテンスのおき方などの基本的な決まりごとについて		(2) Details of instructors' practical work experience related to the course
ンテンスのおき方などの基本的な決まりことについて いまわし、電子ツールなど論文作成の実際についても		(3) Details of practical classes delivered based on instructors' practical work experience
回,ワークショップと論文発表。受講生を数グループ らい、それを講師の指導により、より実践的な論文作 を発表し、それの効果的な発表のためのテクニックを	成の技能の修得とする。また、作成した論文	
[Course requirements] 工業化学科先端化学コース配属であること。		
	Continue to 科学英語(先端化学) (2)↓↓↓	
	— — — Continue to 科学英語(先端化学)(2)↓↓↓	
	Continue to 科学英語(先蟠化学)(2)↓↓↓	
Course number	Continue to 科学英語(先端化学)(2)↓↓↓	科学英語(先端化学)(2)
	Graduate School of Engineering Professor,MORI YASUO	科学英語(先端化学)(2) [Textbooks]
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Course title (加d course) Al学英語(先端化学)	Graduate School of Engineering Professor,MORI YASUO Graduate School of Engineering Professor,SHIRAKAWA MASAHIRO	[Textbooks] 特に指定しない [References, etc.]
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____Continue to 科学英語(先端化学)(2)↓↓↓

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分析化学II(先端化学)(2)

*習到達度の確認,1回 ・ボート問題に対する解答および解説を行い、学習到達度を確認する。

Course requirements]

析化学I(工業基礎化学),基礎物理化学A,B

ivaluation methods and policy] 末試験の成績を基本とするが、平常点およびレポートを考慮することがある。

[Textbooks]

aniel C. Harris 『Quantitative Chemical Analysis』 (W. H. Freeman) ISBN:9781464135385 (9th-ed.)

References, etc.]

(Reference books) クリスチャン『分析化学I [原書第6版]』(丸善)ISBN:9784621075555 Gary D. Christian 『分析化学II [原書第6版]』(丸善)ISBN:9784621075555

[Study outside of class (preparation and review)] 教科書・参考書等を読み、講義で学ぶことを事前に把握するとともに、講義中に十分理解できなか った箇所の理解に努める。

(Other information (office hours, etc.)) 教科書に出てくる重要な単語(分析化学を習得する上で重要な概念)に対応する日本語を表とした プリントを配布する。

注意:「分析化学Ⅱ(工業基礎化学)」を、すでに単位修得した学生が「分析化学Ⅱ(先端化学)」 を履修し単位修得した場合、増加単位となる。