

## Fundamentals of Physical Chemistry (2.0credits) (物理化学基礎論)

Course Type	Basic Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	Spring Semester ,every other year	Spring Semester ,every other year	Spring Semester ,every other year
Lecturer	Atsushi Satsuma Professor ShinodaWataru Associate Professor Kyoichi SAWABE Lecturer	Tsukasa TORIMOTO Professor Shushi SUZUKI Associate Professor	Koichi KIKUTA Professor Jun KUMAGAI Associate Professor

### Course Purpose

This lecture aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our basic knowledge in physical chemistry. The course is aimed to understand the principle and to attain the applicability of thermodynamics, chemical reaction kinetics, quantum chemistry, etc. which are necessary in various fields as the basis of Physical Chemistry.

### Prerequisite Subjects

Thermodynamics, quantum chemistry, chemical kinetics, structural chemistry, electrochemistry, catalysis/surface chemistry, inorganic and physical chemistry exercises, photochemistry, radiation chemistry, polymer physical chemistry

### Course Topics

This is an omnibus-style class including the following contents in the field of graduate-level physical chemistry related to thermodynamics, chemical reactions, and quantum mechanics.

1. Mechanism and surface of catalytic reaction, various catalysts
2. Industrial use of catalysts
3. Basics of statistical mechanics
4. Molecular Dynamics Method II
5. Quantum chemical calculations
6. Basics of Electrochemistry and Photoelectrochemistry
7. Design and application of nanomaterials
- 8 Light absorption and emission by organic molecules
- 9 Characteristics and mechanism of photochemical reaction
10. Photochemical reaction and material chemistry

Prepare for the next class and understand the meaning of technical terms.

### Textbook

In case of necessity, printed handouts will be distributed in each lecture.

### Additional Reading

Textbooks and papers are designated for each week.

### Grade Assessment

Credits will be awarded to those students who score 60 or more based on the evaluation of academic achievements and attendance rate. The academic achievement is evaluated by examination, report, quiz or by their combination.

### Notes

We should understand the lectures on physical chemistry in undergraduate course.

### Contacting Faculty

Do not hesitate to ask any questions during the class, or to have an appointment with each lecturer by e-mail.

satsuma@chembio.nagoya-u.ac.jp(Satsuma)

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## Fundamentals of Solide State Chemistry (2.0credits) (固体化学基礎論)

Course Type	Basic Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	Spring Semester ,every other year	Spring Semester ,every other year	Spring Semester ,every other year
Lecturer	Ryoutarou MATSUDA Professor NAKANISHI Kazuki Professor Joji HASEGAWA Designated Associate Professor	Chikara OHTUKI Professor Ayae Narutaki Professor	OSADA Minoru Professor KOBAYASHI Makoto Associate Professor

### Course Purpose

The purpose of this course is to understand important contents of solid-state chemistry including inorganic chemistry, coordination chemistry, structural chemistry, inorganic material chemistry, and crystallography, in order to acquire the ability to create new materials and substances that support a sustainable society.

In this course, the cutting-edge researchers will provide basic to the latest topics on energy-related materials, inorganic-organic hybrid materials, nanostructured materials, and biomaterials so that students will deepen understanding of these areas.

By the end of this course, students will be able to design new materials with a flexible idea, taking a bird's-eye view of the functions that solid materials manifest.

### Prerequisite Subjects

Fundamental Chemistry I, Fundamental Chemistry II, Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, and Inorganic Material Chemistry

### Course Topics

Each faculty will give lectures in the omnibus style on solid-state chemistry, including inorganic chemistry, complex chemistry, structural chemistry, inorganic material chemistry, and crystallography. The topics include followings.

1. Energy-related (storage, conversion, etc.) materials
2. Inorganic-organic materials
3. Nanostructured materials
4. Nanoparticles
5. Biomaterials
6. Porous materials

Examinations or reports will be assigned after the classes.

References such as scientific papers will be provided in the classes for further reading.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

A. R. West: Solid State Chemistry, WILEY

### Grade Assessment

## Fundamentals of Solide State Chemistry (2.0credits) (固体化学基礎論)

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Students should understand important contents of solid-state chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Fundamental Chemistry I, Fundamental Chemistry II, Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, and Inorganic Material Chemistry.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the class. Otherwise, contact the professors by e-mail in advance.

Prof. Ryotaro Matsuda (ryotaro.matsuda@chembio.nagoya-u.ac.jp)

Prof. Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Prof. Minoru Osada (mosada@imass.nagoya-u.ac.jp)

Prof. Kazuki Nakanishi (dknakanishi@imass.nagoya-u.ac.jp)

Assoc. Prof. Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assoc. Prof. Makoto Kobayashi (mkoba@imass.nagoya-u.ac.jp)

Assoc. Prof. George Hasegawa (h-george@imass.nagoya-u.ac.jp)

## Fundamentals of Molecular and Macromolecular Chemistry (2.0credits) (有機・高分子化学基礎論)

Course Type	Basic Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Lecturer	TakahiroSEKI Professor	Eiji YASHIMA Professor	MasamiKAMIGAITO Professor
	Kazuaki ISHIHARA Professor	Takashi OOI Professor	Hiroshi SHINOKUBO Professor
	MakotoYAMASHITA Professor	Atsushi TAKANO Associate Professor	Yukikazu Takeoka Associate Professor
	Daisuke URAGUCHI Associate Professor	Yoshihiro MIYAKE Associate Professor	Tomoyuki IKAI Associate Professor
	Kosuke OMATSU Designated Associate Professor	Junichi ITO Lecturer	Atsushi NORO Lecturer

### Course Purpose

We study fundamental topics related to organic chemistry and macromolecular chemistry including organic material chemistry, organoelement Chemistry, organic reactions, catalysis in organic synthesis, physical chemistry of polymers, organic chemistry of macromolecules, macromolecular assembly systems, and supramolecular polymer chemistry. The purpose of this lecture is to understand fundamental topic in organic and macromolecular chemistry for learning advanced chemistry, and to gain applied, comprehensive, bird's-eye view skills.

### Prerequisite Subjects

### Course Topics

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Fundamentals of Biomolecular Chemistry (2.0credits) (分子生命化学基礎論)

Course Type	Basic Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	Spring Semester ,every other year	Spring Semester ,every other year	Spring Semester ,every other year
Lecturer	Yoshinobu BABA Professor HAYASHI Gosuke Associate Professor Yukiko KAMIYA Associate Professor	Takao YASUI Associate Professor Hiroyuki ASANUMA Professor	Hiroshi MURAKAMI Professor Hiromu KASHIDA Associate Professor

### Course Purpose

This course aims to help students acquire an understanding of basic knowledge and application about nanobio analytical chemistry, chemical biotechnology, and supramolecular biochemistry. This course introduces methodology relating to measurements and evaluation of substances from various points of view.

### Prerequisite Subjects

basic class of department of biomolecular engineering

### Course Topics

1. Nanobio analytical chemistry
2. Chemical biotechnology
3. Supramolecular biochemistry

### Textbook

no textbook, handouts as necessary

### Additional Reading

### Grade Assessment

Your overall grade in the class will be decided based on the following:

- Attendance: 30%
- Report: 70%

### Notes

### Contacting Faculty

You may contact the teacher after his/her lecture.  
Otherwise you may contact us by email.

## Fundamentals of Biosystem Engineering (2.0credits) (生命システム工学基礎論)

Course Type	Basic Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	Spring Semester ,every other year	Spring Semester ,every other year	Spring Semester ,every other year
Lecturer	KIYONAKA Shigeki Professor Kazunori SHIMIZU Associate Professor	Hiroyuki HONDA Professor Atuo SUZUKI Associate Professor	Katsutoshi HORI Professor HajimeNAKATANI Lecturer

### Course Purpose

The purpose of this course is to analyze recent topics in biotechnology fields from the basic and applied aspects and to discuss future developments from a biotechnological standpoint.

By learning this lecture, the goal is to be able to:

1. Learn and explain recent topics in basics and applications in the field of biotechnology.
2. Give an opinion on the future development of this field based on sufficient awareness of the current situation.

### Prerequisite Subjects

Biochemistry with exercises 1-4, Biochemistry 5.

Fundamentals of Chemical Engineering.

Bioreaction Engineering.

Biological data science and engineering.

### Course Topics

1. Drug development.
2. Food technology.
3. Hormones and signal transduction.
4. Cell cycle and tumor.
5. Developmental technology.
6. Biochemical engineering .

### Textbook

Introduce in the class.

### Additional Reading

Biochemistry, D. Voet & J. G. Voet, 4th Edition.

Biochemsiry, J.M. Berg, L. Stryer, J.L. Tymoczko & G.L. Gatto, 8th Edition.

### Grade Assessment

This course is evaluated by presentation, report and discussion.

### Notes

No requirements.

### Contacting Faculty

We always accept your questions.

"Seminar on Applied Physical Chemistry 1A " (2.0credits) (応用物理化学セミナー 1A)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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#### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

#### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

#### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

#### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

#### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

#### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

#### Notes

N/A

#### Contacting Faculty

Accept and respond to the questions raised during the seminar.



## Seminar on Applied Physical Chemistry 1A (2.0credits) (応用物理化学セミナー 1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	Atsushi Satsuma Professor	Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.1 Analysis of catalytic reactions by reaction kinetics2 Understanding catalytic reactions by thermodynamics and quantum chemistry3 Basics and applications of spectroscopyFour. Solid surface phenomenaFive. Basics and applications of industrial catalysts6 Resources and energy chemistry7 Topics in catalytic chemistry and material chemistryBefore the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions. Grade point follows the rule of University. Speakers must prepare reports before their presentations. (Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address. A. Satsuma: satsuma@chembio.nagoya-u.ac.jp K. Sawabe : sawabe@chembio.nagoya-u.ac.jp A. Oda : akira@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1A (2.0credits) (応用物理化学セミナー 1A)

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Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in a nanometer scale and then obtain basic skills to design and fabricate efficient energy conversion systems.

### Goals and objectives

1. To understand the changes in physicochemical properties of metal and semiconductor materials in a nano-scale region.
2. To design an efficient energy conversion system based on photochemical and electrochemical methods. Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to analyze experimental results.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations. A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1A (2.0credits) (応用物理化学セミナー 1A)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 1A (2.0credits) (応用物理化学セミナー 1A)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	Jun KUMAGAI Associate Professor

### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course.

Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly.

Achievement target2:

You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly.
2. By the day of your literature introduction, read a paper related to your master's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents.
3. You propose ideas to advance your master's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks.

You can select papers should be read and introduced according to your master's thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluated the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants must have completed credits that meet the graduation requirements of the Department of Chemistry and Biotechnology, Faculty of Engineering, Nagoya University.

### Contacting Faculty

The instructor:

Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1B (2.0credits) (応用物理化学セミナー 1B)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	ShinodaWataru Associate Professor    Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 1B (2.0credits) (応用物理化学セミナー 1B)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Autumn Semester	
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.

- 1 Analysis of catalytic reactions by reaction kinetics
- 2 Understanding catalytic reactions by thermodynamics and quantum chemistry
- 3 Basics and applications of spectroscopy
- Four. Solid surface phenomena
- Five. Basics and applications of industrial catalysts
- 6 Resources and energy chemistry
- 7 Topics in catalytic chemistry and material chemistry

Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Grade point follows the rule of University.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: [satsuma@chembio.nagoya-u.ac.jp](mailto:satsuma@chembio.nagoya-u.ac.jp)

K. Sawabe : [sawabe@chembio.nagoya-u.ac.jp](mailto:sawabe@chembio.nagoya-u.ac.jp)

A. Oda : [akira@chembio.nagoya-u.ac.jp](mailto:akira@chembio.nagoya-u.ac.jp)

## Seminar on Applied Physical Chemistry 1B (2.0credits) (応用物理化学セミナー 1B)

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Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in a nanometer scale and then obtain basic skills to design and fabricate efficient energy conversion systems.

Goals and objectives

1. To understand the changes in physicochemical properties of metal and semiconductor materials in a nano-scale region.
2. To design an efficient energy conversion system based on photochemical and electrochemical methods. Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to analyze experimental results.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp



## Seminar on Applied Physical Chemistry 1B (2.0credits) (応用物理化学セミナー 1B)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 1B (2.0credits) (応用物理化学セミナー 1B)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course.

Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly.

Achievement target2:

You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly.
2. By the day of your literature introduction, read a paper related to your master's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents.
3. You propose ideas to advance your master's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks.

You can select papers should be read and introduced according to your master's thesis research.

### Additional Reading

Instruct during class as needed.

### Grade Assessment

Evaluate the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants must have completed credits that meet the graduation requirements of the Department of Chemistry and Biotechnology, Faculty of Engineering, Nagoya University.

### Contacting Faculty

The instructor:

Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1C (2.0credits) (応用物理化学セミナー 1C)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 1C (2.0credits) (応用物理化学セミナー 1C)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.

- 1 Analysis of catalytic reactions by reaction kinetics
- 2 Understanding catalytic reactions by thermodynamics and quantum chemistry
- 3 Basics and applications of spectroscopy
- Four. Solid surface phenomena
- Five. Basics and applications of industrial catalysts
- 6 Resources and energy chemistry
- 7 Topics in catalytic chemistry and material chemistry

Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Grade point follows the rule of University.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: [satsuma@chembio.nagoya-u.ac.jp](mailto:satsuma@chembio.nagoya-u.ac.jp)

K. Sawabe : [sawabe@chembio.nagoya-u.ac.jp](mailto:sawabe@chembio.nagoya-u.ac.jp)

A. Oda : [akira@chembio.nagoya-u.ac.jp](mailto:akira@chembio.nagoya-u.ac.jp)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in a nanometer scale and then obtain basic skills to design and fabricate efficient energy conversion systems.

Goals and objectives

1. To understand the changes in physicochemical properties of metal and semiconductor materials in a nano-scale region.
2. To design an efficient energy conversion system based on photochemical and electrochemical methods. Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to analyze experimental results.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1C (2.0credits) (応用物理化学セミナー 1C)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Report and discussion Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course. Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly. Achievement target2: You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly. 2. By the day of your literature introduction, read a paper related to your master's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents. 3. You propose ideas to advance your master's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks. You can select papers should be read and introduced according to your master's thesis research.

### Additional Reading

Instruct during class as needed.

### Grade Assessment

Evaluate the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants must have completed credits that meet the graduation requirements of the Department of Chemistry and Biotechnology, Faculty of Engineering, Nagoya University.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp



## Seminar on Applied Physical Chemistry 1D (2.0credits) (応用物理化学セミナー 1D)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	ShinodaWataru Associate Professor    Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 1D (2.0credits) (応用物理化学セミナー 1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Atsushi Satsuma Professor	Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.

- 1 Analysis of catalytic reactions by reaction kinetics
- 2 Understanding catalytic reactions by thermodynamics and quantum chemistry
- 3 Basics and applications of spectroscopy
- Four. Solid surface phenomena
- Five. Basics and applications of industrial catalysts
- 6 Resources and energy chemistry
- 7 Topics in catalytic chemistry and material chemistry

Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Grade point follows the rule of University.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: [satsuma@chembio.nagoya-u.ac.jp](mailto:satsuma@chembio.nagoya-u.ac.jp)

K. Sawabe : [sawabe@chembio.nagoya-u.ac.jp](mailto:sawabe@chembio.nagoya-u.ac.jp)

A. Oda : [akira@chembio.nagoya-u.ac.jp](mailto:akira@chembio.nagoya-u.ac.jp)

## Seminar on Applied Physical Chemistry 1D (2.0credits) (応用物理化学セミナー 1D)

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Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in a nanometer scale and then obtain basic skills to design and fabricate efficient energy conversion systems.

### Goals and objectives

1. To understand the changes in physicochemical properties of metal and semiconductor materials in a nano-scale region.
2. To design an efficient energy conversion system based on photochemical and electrochemical methods. Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to analyze experimental results.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 1D (2.0credits) (応用物理化学セミナー 1D)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 1D (2.0credits) (応用物理化学セミナー 1D)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly. 2. By the day of your literature introduction, read a paper related to your master's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents. 3. You propose ideas to advance your master's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks. You can select papers should be read and introduced according to your master's thesis research.

### Additional Reading

Instruct during class as needed.

### Grade Assessment

Evaluate the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants must have completed credits that meet the graduation requirements of the Department of Chemistry and Biotechnology, Faculty of Engineering, Nagoya University.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 1A (2.0credits) (固体化学セミナー 1A)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Spring Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 1A (2.0credits) (固体化学セミナー 1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society.

By the end of this seminar, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, by applying the principle, students will discuss the technology required for the creation of materials in medicine (biomaterials), acquire knowledge and research techniques on the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given.

1. General demands on biomaterials
2. Definitions of biomaterials and their properties
3. Definitions of ceramic materials and sintering behavior
4. Synthesis of ceramics
5. Microstructure and properties of ceramics
6. Synthesis of protein by genetic engineering

Students should prepare materials necessary for discussion by the day of the seminar.

Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

Introduction to Bioceramics, Ed. by L. L. Hench and J. Wilson, World Scientific, Singapore, 1993.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes



## Seminar on Solid State Chemistry 1A (2.0credits) (固体化学セミナー 1A)

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Students should have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

### Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 1A (2.0credits) (固体化学セミナー 1A)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel nano-carbon and inorganic nano materials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.

## Seminar on Solid State Chemistry 1A (2.0credits) (固体化学セミナー 1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

The lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained. You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Inorganic Chemistry, Organic Chemistry, Chemistry of Inorganic Synthesis and Inorganic Materials, Physical Chemistry, Solid State Chemistry

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

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

### Additional Reading

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 1B (2.0credits) (固体化学セミナー 1B)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 1B (2.0credits) (固体化学セミナー 1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society.

By the end of this seminar, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, by applying the principle, students will discuss the technology required for the creation of materials in medicine (biomaterials), acquire knowledge and research techniques on the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given.

1. Phase diagram and formation of glass
2. Structure and properties of glass
3. Crystalization of liquid
4. Synthesis of glass-ceramics
5. Surface reaction of glass in body environment
6. Structure, Properties, and functions of biopolymers

Students should prepare materials necessary for discussion by the day of the seminar.

Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

Introduction to Bioceramics, Ed. by L. L. Hench and J. Wilson, World Scientific, Singapore, 1993.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

## Seminar on Solid State Chemistry 1B (2.0credits) (固体化学セミナー 1B)

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Students should have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

### Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 1B (2.0credits) (固体化学セミナー 1B)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel nano-carbon and inorganic nano materials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.

## Seminar on Solid State Chemistry 1B (2.0credits) (固体化学セミナー 1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following Solid State Chemistry Seminar 1A, the lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 1A

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

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

### Additional Reading

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.



## Seminar on Solid State Chemistry 1C (2.0credits) (固体化学セミナー 1C)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	2 Spring Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 1C (2.0credits) (固体化学セミナー 1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society. By the end of this seminar, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, by applying the principle, students will discuss the technology required for the creation of materials in medicine (biomaterials), acquire knowledge and research techniques on the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given. 1. Analysis of reaction between glass and body fluid 2. Design of bioactive materials 3. Biomimetic processing Students should prepare materials necessary for discussion by the day of the seminar. Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008. Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995. Introduction to Bioceramics, Ed. by L. L. Hench and J. Wilson, World Scientific, Singapore, 1993.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Students should have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance. Contact information: Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp) Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp) Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 1C (2.0credits) (固体化学セミナー 1C)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel nano-carbon and inorganic nano materials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.

## Seminar on Solid State Chemistry 1C (2.0credits) (固体化学セミナー 1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following Solid State Chemistry Seminar 1A, the lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 1A, 1B

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

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

### Additional Reading

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 1D (2.0credits) (固体化学セミナー 1D)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	2 Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 1D (2.0credits) (固体化学セミナー 1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society.

By the end of this seminar, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, by applying the principle, students will discuss the technology required for the creation of materials in medicine (biomaterials), acquire knowledge and research techniques on the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given.

1. Organic-inorganic hybrids
2. Hyperthermia with ceramic materials
3. Biomaterials for tissue regeneration

Students should prepare materials necessary for discussion by the day of the seminar.

Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

Introduction to Bioceramics, Ed. by L. L. Hench and J. Wilson, World Scientific, Singapore, 1993.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Students should have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

### Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 1D (2.0credits) (固体化学セミナー 1D)

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Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel nano-carbon and inorganic nano materials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.



## Seminar on Solid State Chemistry 1D (2.0credits) (固体化学セミナー 1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following Solid State Chemistry Seminar 1C, the lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 1A, 1B, 1C

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

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

### Additional Reading

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

### Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant's research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

#### Textbook

Will be introduced at the host laboratory depending on the research subject

#### Additional Reading

Will be introduced at the host laboratory if necessary

#### Grade Assessment

Conducting research in an abroad laboratory for one semester and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

#### Notes

Nothing particularly needed

#### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

### Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant's research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

#### Textbook

Will be introduced at the host laboratory depending on the research subject

#### Additional Reading

Will be introduced at the host laboratory if necessary

#### Grade Assessment

Conducting research in an abroad laboratory for two semesters and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

#### Notes

Nothing particularly needed

#### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Advanced Catalyst Design (2.0credits) (触媒設計学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer

### Course Purpose

In this lecture, we learn the principles and applications of solid catalysts utilizing surface chemical functions. By understanding catalysts and solid surfaces that promote chemical reactions in atomic and molecular levels, we will develop the ability to create innovative materials and design chemical processes that support a sustainable society. It is necessary to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc. In this lecture, the goal is to have the following knowledge and skills at the end of the lecture.

1. Understand the principles of catalysis through learning examples of heterogeneous catalysis, adsorption phenomena, catalysis rates, and catalyst structure-activity relationships.
2. Understand the design guidelines and structural analysis of solid catalysts and apply them to your own research.
- 3 Understand and apply theory describing the rate of elementary reactions and theory describing the mechanism and rate of complex reactions.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

1. General introduction, adsorption
2. Solid acids and bases, oxidation catalysts, metal catalysts, metal oxide catalysts, environmental catalysts
3. Characterizations for solids and surfaces
- 4, Crystallography of solid surface
5. Theoretical calculation for material design

Please read the documents for the next week in advance. We will check the preparation by quizzes in every week.

### Textbook

Documents will be provided.

### Additional Reading

R.A. van Santen, Modern Heterogeneous Catalysis, Wiley-VCH, Weinheim(2017).

### Grade Assessment

Report (50%) and examination (50%).

(Evaluation criteria) A total score of 60 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is preferred.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: satsuma@chembio.nagoya-u.ac.jp

K. Sawabe : sawabe@chembio.nagoya-u.ac.jp

## Advanced Material Design Chemistry (2.0credits) (材料設計化学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Materials Chemistry	
Starts 1	Autumn Semester ,every other year	
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor

### Course Purpose

More Precise designing of advanced catalysts and semiconductor devices requires more precise control of surface atoms and molecules in the nanoscale. The aim of this lecture is to learn the basic concept of surface science from the viewpoint of designing surface structures in the nanoscale and to discuss about the future prospects on catalysts, semiconductor devices, and sensors.

### Prerequisite Subjects

Physical Chemistry, Inorganic Chemistry. Those who did not graduate from a chemistry department are recommended to take course 'Fundamentals of Physical Chemistry' (Lecture code: 6323) in advance.

### Course Topics

The following 4 items of the lecture contents on surface science will be treated: 1. Ultrahigh vacuum techniques, 2. Surface analysis methods, 3. Physics and chemistry of atoms/molecules on surfaces, 4. Surface science for material design, and 5. Future Expected-nanotechnology

### Textbook

Lecture materials are downloaded and distributed in PDF format from NUCT. Please bring them as printed or electronic data before each lecture. You can also view electronic data using a tablet or PC during the lecture.

### Additional Reading

1. "Nanotechnology (Vol.8, Nanostructured Surfaces)" (Wiley-VCH) Ed. Lifeng Chi.
2. "Basic Surface Chemistry" (Kagaku Dojin), Yasuhiro Iwasawa, Ken-ichi Fukui, Jun Yoshinobu, Junji Nakamura
3. "Application to Surface Science and Catalysis Science (Introduction to Modern Chemistry 14)" (IWANAMI SHOTEN), Maki Kawai, Kazunari Domen
- . "Human Life and Surface Science (Modern Surface Science Series 5)" (Kyoritsu Shuppan), Ed. Juji Inukai, Surface Science Society of Japan

### Grade Assessment

Grades will be based on class attendance rate, presentation in classes, and the homework. Getting more than 60% points will be required to get a credit of the lecture. Please do not use a copy or a paraphrase of anyone's work.

### Notes

No course requirements are needed.

### Contacting Faculty

Office hours: Monday to Friday, 9:00 to 17:00, and by appointment.

## Advanced Energy Conversion Chemistry (2.0credits) (エネルギー環境化学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Autumn Semester ,every other year
Lecturer	Koichi KIKUTA Professor Jun KUMAGAI Associate Professor

### Course Purpose

This lecture is composed of basis and applications for energy and environmental chemistry. For energy chemistry, some applications of energy conversion materials and energy conversion devices such as solid oxide fuel cell are introduced. For environmental chemistry, radiation chemistry, radiation biology and therapy, ionizing radiation for industrial applications, cosmic-ray related with climate change are introduced on the basis of physical interactions between ionizing radiation and matters.

### Prerequisite Subjects

Basic lectures for inorganic, physical, and analytical chemistry

### Course Topics

Current condition of energy consumption Energy conversion materials and devices Topics on energy, environment, and resources Discover history of ionizing radiation Interactions between ionizing radiations and matters Radiation chemistry Radiations in univers, solar systems, and earth. Radiation biology including therapy. Ionizing radiation for industrial applications. In this course, assignments will be given as needed.

### Textbook

Reference books are as follows. Documents based on the reference books are handed out to the students.

### Additional Reading

"Basis for the safe treatment of ionizing radiation" edited by K Nishizawa and T. Iida, Nagoya Univ. publication company.

### Grade Assessment

Goal attainment level is evaluated by exercises and reports. Credits will be given if students fully understand the contents of the class.

### Notes

N/A

### Contacting Faculty

Students may ask or discuss with professors at lecture's room after the lecture. Make appointment by email or phone when you want to contact with professors at out of lecture. Prof. Koichi Kikuta (ext. 3345; kik@chembio.nagoya-u.ac.jp) Associate Prof. Jun Kumagai (ext. 2591; kumagai@imass.nagoya-u.ac.jp)



Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Autumn Semester ,every other year
Lecturer	Ryoutarou MATSUDA Professor

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### Course Purpose

The aim of this lecture is to deepen the understanding of the synthesis, structure, and physical properties of various materials, mainly inorganic and coordination compounds, and to achieve the application skills for developing functions of nanospace materials such as molecular adsorption.

By learning this lecture, the goal is to be able to:

1. Explain the typical synthetic methods of inorganic and coordination compounds.
2. Understand the fundamentals of crystallography and explain the crystal structure of inorganic and coordination compounds.
- 3 Explain the typical functions of inorganic and coordination compounds.
4. Explain the functions and applications of nanospace materials.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Matrials

### Course Topics

1. Synthetic method of inorganic and coordination compounds.
2. Structures of inorganic and coordination compounds.
3. Functions and properties of inorganic and coordination compounds.
4. Functions and applications of nanospace materials.

Read the previous lecture materials and designated part of the textbook before each class. After class, read and review textbooks and lecture materials. In addition, if a report is requested, write and submit it.

### Textbook

Specify as appropriate as the lecture progresses

### Additional Reading

Introduce as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The lecture will be given in Japanese or English.

### Contacting Faculty

Questions after the lecture will be accepted and answered in the lecture room.

Questions at other times will be accepted and answered by email.

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Materials Chemistry	
Starts 1	Autumn Semester ,every other year	
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor

### Course Purpose

The purpose of this course is to understand basic concept of biomedical materials including inorganic solid materials (ceramics), organic polymer materials and biomacromolecules in order to acquire the ability to create new materials and their applications that support a sustainable society.

### Goal of this course

1. to acquire fundamental knowledge of design concept and synthesis of biomedical materials
2. to understand the content of research papers on state-of-the-art biomedical materials
3. to acquire the ability to estimate the value and future outlook of biomedical materials.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Lectures on the following contents will be given.

1. General demands of biomaterials
2. Ceramics for artificial joints
3. Bioactive glass
4. Design of bioactive materials
5. Bioactive organic-inorganic hybrids for bone repairing
6. Development of functional materials through biomimetic processing
7. Crystallization in bio-like environment
8. Drug delivery system
9. Regenerative medicine and polymer scaffold
10. Design and synthesis of polypeptide-based biomaterials

Examinations or reports will be assigned after the classes.

References such as scientific papers will be provided in the classes for further reading.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

- Bioceramics and their clinical applications, Ed. By T. Kokubo, Woodhead Publishing Limited, 2008.  
 Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.  
 Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008.  
 Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.  
 Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.  
 Introduction to Bioceramics, Ed. by L. L. Hench and J. Wilson, World Scientific, Singapore, 1993.  
 Inorganic Functional Materials, Ed. by K. Koumoto, Tokyo Kagakuojin (2009)(in Japanese)  
 Ceramic Biomaterials, Ed. by Okazaki et al., Corona Publishing, 2009. (in Japanese)  
 Biomaterials, Ed. by J. Tanaka et al., Uchida Rokakuho Publishing, 2008. (in Japanese)

### Grade Assessment

Students should achieve the goal of this course. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is recommended that students have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the lecture hours will be accepted in the lecture room or Professors' room after the lecture. Otherwise, contact the Professors by e-mail in advance.

Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

## Advanced Porous Materials Chemistry (2.0credits) (多孔材料化学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

In this lecture, the research and development trend of advanced materials such as ceramics and nanocarbons for environmental issues will be introduced. Especially, silicate ceramics, amorphous or polycrystalline, and siloxane-based organic-inorganic hybrid materials will be included in the topics.

### Prerequisite Subjects

Inorganic Chemistry, Analytical Chemistry, Physical Chemistry, Inorganic Materials Chemistry, Chemistry of Catalyst and Catalysis, Environmental Chemistry, Materials Science

### Course Topics

1) Novel processing of ceramic materials2) Microstructure control of ceramic materials3) Novel properties of ceramic materials4) Structure tailoring method of ceramics materials through liquid-phase synthesis.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

A.R. West "Solid State Chemistry and its Applications", Wiley; 2nd Edition

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

answered mainly during the lecture

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Autumn Semester ,every other year
Lecturer	OSADA Minoru Professor KOBAYASHI Makoto Associate Professor

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### Course Purpose

The objective of this course is to study the synthesis, processing, properties and applications of nanomaterials, to develop a basic understanding the "state-of-the-art" in nanomaterials science and nanotechnology. From the lecture, fundamental concept on nanomaterial researches will be learned.

### Prerequisite Subjects

Inorganic Chemistry, Inorganic Materials Chemistry, (Fundamental Solid State Chemistry)

### Course Topics

1. Nanotechnology
2. Nanomaterials
3. 1D nanomaterials
4. 2D nanomaterials
5. Nano-materials design & characterization
6. Nano-processing technology, Nano-fabrication
7. Electronic applications of nanomaterials
8. Energy & environmental applications of nanomaterials

On each lecture, reference information such as scientific paper will be given.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

A. R. West: Solid State Chemistry, WILEY

William D. Callister Jr.: Materials Science and Engineering, Wiley

When necessary, other textbooks will be introduced.

### Grade Assessment

Concepts and principle of nanotechnology and nanomaterial researches should be understood properly. Reports and examination credits will be awarded to those students who score 60 or more. Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

We have office hours after the lecture and accept questions about lecture contents.

## Selected Topics on Applied Physical Chemistry (1.0credits) (应用物理化学特别讲义)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	Part-time Faculty

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### Course Purpose

The objective of this lecture is that we become a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. We study advanced topics related to physical chemistry from the front-line researchers in the fields of catalysis, surface chemistry, photochemistry, electrochemistry, nanomaterials, environmental chemistry, computational chemistry, and so on. The aim of this lecture is to expand our knowledge, creativity and applied skills in physical chemistry, to become integrated professionals.

### Prerequisite Subjects

Thermodynamics, quantum chemistry, chemical kinetics, structural chemistry, electrochemistry, catalysis/surface chemistry, inorganic and physical chemistry exercises, photochemistry, radiation chemistry, polymer physical chemistry

### Course Topics

We learn advanced topics related to physical chemistry, such as catalysis, surface chemistry, photochemistry, electrochemistry, nanomaterials, environmental chemistry, computational chemistry, and so on. The contents of the lecture are 1. Review of physical chemistry for undergraduate students, 2. General research trends in the field, 3. Background of cutting edge fields, 4. Research trend in cutting edge fields, and 5. Q & A session, discussion.

### Textbook

Basically, textbooks are not prescribed. In case of necessity, printed handouts will be distributed in each lecture.

### Additional Reading

In case of necessity, printed handouts, papers and references will be distributed in each lecture.

### Grade Assessment

Required-work consists of homework assignments, etc., presented by each teacher and attendance rate. Credits will be awarded to those students who score 60 or more.

### Notes

We should understand the lectures on physical chemistry in undergraduate course.

### Contacting Faculty

Do not hesitate to ask any questions during the class.

## Selected Topics on Applied Physical Chemistry (1.0credits) (应用物理化学特别讲义)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	Part-time Faculty

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### Course Purpose

The objective of this lecture is that we become a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. We study advanced topics related to physical chemistry from the front-line researchers in the fields of catalysis, surface chemistry, photochemistry, electrochemistry, nanomaterials, environmental chemistry, computational chemistry, and so on. The aim of this lecture is to expand our knowledge, creativity and applied skills in physical chemistry, to become integrated professionals.

### Prerequisite Subjects

Thermodynamics, quantum chemistry, chemical kinetics, structural chemistry, electrochemistry, catalysis/surface chemistry, inorganic and physical chemistry exercises, photochemistry, radiation chemistry, polymer physical chemistry

### Course Topics

We learn advanced topics related to physical chemistry, such as catalysis, surface chemistry, photochemistry, electrochemistry, nanomaterials, environmental chemistry, computational chemistry, and so on. The contents of the lecture are 1. Review of physical chemistry for undergraduate students, 2. General research trends in the field, 3. Background of cutting edge fields, 4. Research trend in cutting edge fields, and 5. Q & A session, discussion.

### Textbook

Basically, textbooks are not prescribed. In case of necessity, printed handouts will be distributed in each lecture.

### Additional Reading

In case of necessity, printed handouts, papers and references will be distributed in each lecture.

### Grade Assessment

Required-work consists of homework assignments, etc., presented by each teacher and attendance rate. Credits will be awarded to those students who score 60 or more.

### Notes

We should understand the lectures on physical chemistry in undergraduate course.

### Contacting Faculty

Do not hesitate to ask any questions during the class.

## Selected Topics on Solid State Chemistry I (1.0credits) (固体化学特別講義 )

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	Part-time Faculty

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### Course Purpose

The objective of this lecture is that we become a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. We study advanced topics related to solid-state chemistry from the front line researchers in the fields of organic-inorganic hybrid materials, ceramics, biocompatible materials, nanocarbon materials, chemical reactions at ultra-low temperature and so on. The aim of this lecture is to expand our knowledge, creativity and applied skills in solid-state chemistry, to become integrated professionals.

### Prerequisite Subjects

Thermodynamics, structural chemistry, electrochemistry, inorganic chemistry, catalysis/surface chemistry, inorganic and physical chemistry exercises, photochemistry, radiation chemistry, chemistry of inorganic reaction, chemistry of inorganic material

### Course Topics

We learn advanced topics related to solid-state chemistry, such as organic-inorganic hybrid materials, ceramics, biocompatible materials, nanocarbon materials, chemical reactions at ultra-low temperature, and so on. The contents of the lecture are 1. Review of solid-state chemistry for undergraduate students, 2. General research trends in the field, 3. Background of cutting edge fields, 4. Research trend in cutting edge fields, and 5. Q & A session, discussion.

### Textbook

Basically, textbooks are not prescribed. In case of necessity, printed handouts will be distributed in each lecture.

### Additional Reading

In case of necessity, printed handouts, papers and references will be distributed in each lecture.

### Grade Assessment

Required-work consists of homework assignments, etc., presented by each teacher and attendance rate. Credits will be awarded to those students who score 60 or more.

### Notes

We should understand the lectures on physical chemistry in undergraduate course.

### Contacting Faculty

Do not hesitate to ask any questions during the class.



## Selected Topics on Solid State Chemistry II (1.0credits) (固体化学特別講義 )

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Materials Chemistry
Starts 1	Spring Semester ,every other year
Lecturer	Part-time Faculty

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### Course Purpose

The objective of this lecture is that we become a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. We study advanced topics related to solid-state chemistry from the front line researchers in the fields of organic-inorganic hybrid materials, ceramics, biocompatible materials, nanocarbon materials, chemical reactions at ultra-low temperature and so on. The aim of this lecture is to expand our knowledge, creativity and applied skills in solid-state chemistry, to become integrated professionals.

### Prerequisite Subjects

Thermodynamics, structural chemistry, electrochemistry, inorganic chemistry, catalysis/surface chemistry, inorganic and physical chemistry exercises, photochemistry, radiation chemistry, chemistry of inorganic reaction, chemistry of inorganic material

### Course Topics

We learn advanced topics related to solid-state chemistry, such as organic-inorganic hybrid materials, ceramics, biocompatible materials, nanocarbon materials, chemical reactions at ultra-low temperature, and so on. The contents of the lecture are 1. Review of solid-state chemistry for undergraduate students, 2. General research trends in the field, 3. Background of cutting edge fields, 4. Research trend in cutting edge fields, and 5. Q & A session, discussion.

### Textbook

Basically, textbooks are not prescribed. In case of necessity, printed handouts will be distributed in each lecture.

### Additional Reading

In case of necessity, printed handouts, papers and references will be distributed in each lecture.

### Grade Assessment

Required-work consists of homework assignments, etc., presented by each teacher and attendance rate. Credits will be awarded to those students who score 60 or more.

### Notes

We should understand the lectures on physical chemistry in undergraduate course.

### Contacting Faculty

Do not hesitate to ask any questions during the class.

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

By reading textbooks and articles related to theoretical and computational science, by conducting experiments and exercises, students deepen their understanding of each advanced academic field, and cultivate applied skills, creativity and comprehensive skills in addition to basic skills. Students will be able to perform and analyze the computer experiments and accurately explain the performed experiments and the obtained results.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

### Course Topics

Students makes basic molecular dynamics simulation programs and their analysis programs, execute simulations and analyze the created data for each research topic. The obtained results should be considered and interpreted, and explained.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept questions at any time.

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Materials Chemistry	
Starts 1	1 Spring and Autumn Semester	
Lecturer	Atsushi Satsuma Professor	Kyoichi SAWABE Lecturer
		Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. Exercise of the following research fields: solid catalysis, solid surface, reaction mechanism, kinetics, characterization of solids, quantum chemistry, spectroscopy, physical chemistry, inorganic chemistry, organic chemistry, and related area. We understand the principles of catalysis on solid surfaces (basic skills), design novel catalysts and catalytic systems (applied skills), and integrate them as developing researchers.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.

1. Structure and function of solids
2. Characterizations of solid catalysts
3. Mechanism of catalytic reactions and surface phenomenon
4. Environmental catalysts and natural resources
5. Surface design of organic solids

Reports summarized your topic must be submitted by the lecture day. The score is evaluated through explanations, questions, and discussions in the lecture.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Grade point follows the rule of University.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: satsuma@chembio.nagoya-u.ac.jp

K. Sawabe : sawabe@chembio.nagoya-u.ac.jp

A. Oda : akira@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this course, we understand the phenomena at the interfaces in atomic and molecular scales and then design and fabricate effective photochemical or electrochemical systems.

Goals and objectives

1. To prepare materials having the sizes in a nanometer scale and then clarify their size-dependent physicochemical properties.
2. To fabricate energy conversion systems by the combination of various functional materials and to evaluate their efficiency.

We will learn the basic methods of photochemical and electrochemical preparation for energy conversion systems, and then obtain the abilities to analyze the experimental results qualitatively and quantitatively.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Characterization with electrochemical methods
2. Fabrication of solar cell
3. Preparation of photocatalysts
4. Designing functional materials through controlling nanostructures
5. Evaluation of photochemical and electrochemical properties

Please read the designated literature before starting each experiment.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations and reports. A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during the course, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Koichi KIKUTA Professor

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#### Course Purpose

The aim of this course is to help students acquire an understanding of the fundamental principles of inorganic materials chemistry through the development of functional devices.

#### Prerequisite Subjects

#### Course Topics

#### Textbook

#### Additional Reading

#### Grade Assessment

#### Notes

#### Contacting Faculty

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

In this special experiment and Exercise I, you will learn in detail the measurement principle of electron spin resonance equipment necessary for research in radiation chemistry, radiation biology, and photocatalytic chemistry. You will be able to prepare samples under the correct conditions and to analyze the obtained spectra correctly.

Achievement target 1: You will be able to propose analysis methods according to experimental samples.

Achievement 2: You will be able to measure the samples with the right conditions and analyze the spectra correctly.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. ESR measurement of organic radical and its spectrum analysis are performed.
2. ESR measurement of inorganic material and its spectrum analysis are performed.
3. ESR measurement and spectral analysis of cell-related samples are performed.

### Textbook

"Introduction to Electronic Spin Science & Technology", Supervised by the Society of Electron Spin Science and Technology, Yoneda Publishing.

### Additional Reading

Weil Bolton, "Electron Paramagnetic Resonance"

### Grade Assessment

You will be evaluated by both the experiment and analysis. On the experiments, it is important that whether the ESR measurement sample is properly adjusted and measured under the correct conditions (tuning of resonance state, microwave intensity, field modulation width, time constant, magnetic field sweep range) or not. On the analysis, it is important that whether you can simulate the experimental spectra with appropriate ESR parameters of  $g$  value, hyperfine coupling constants or not. Grading will be decided based on experimental performance (50%) and spectra simulation results (50%).

### Notes

Applicants must have completed credits that meet the graduation requirements of the Department of Chemistry and Biotechnology, Faculty of Engineering, Nagoya University.

### Contacting Faculty

The instructor:

Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	2 Spring and Autumn Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

By reading textbooks and articles related to theoretical and computational science, by conducting experiments and exercises, students deepen their understanding of each advanced academic field, and cultivate applied skills, creativity and comprehensive skills in addition to basic skills. Students will be able to perform and analyze the computer experiments and accurately explain the performed experiments and the obtained results.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry

### Course Topics

Students makes basic molecular dynamics simulation programs and their analysis programs, execute simulations and analyze the created data for each research topic. The obtained results should be considered and interpreted, and explained.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept questions at any time.

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Materials Chemistry	
Starts 1	2 Spring and Autumn Semester	
Lecturer	Atsushi Satsuma Professor	Kyoichi SAWABE Lecturer
		Akira ODA Assistant Professor

### Course Purpose

This seminar aims to be a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. In the lectures, we will improve our research skills based on basic studies. Exercise of the following research fields: solid catalysis, solid surface, reaction mechanism, kinetics, characterization of solids, quantum chemistry, spectroscopy, physical chemistry, inorganic chemistry, organic chemistry, and related area. We understand the principles of catalysis on solid surfaces (basic skills), design novel catalysts and catalytic systems (applied skills), and integrate them as developing researchers.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

The topics will be determined from the following topics, through discussions with faculty members, considering the latest scientific trends and the progress in research of each student.

1. Structure and function of solids
2. Characterizations of solid catalysts
3. Mechanism of catalytic reactions and surface phenomenon
4. Environmental catalysts and natural resources
5. Surface design of organic solids

Reports summarized your topic must be submitted by the lecture day. The score is evaluated through explanations, questions, and discussions in the lecture.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Grade point follows the rule of University.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry for undergraduate students is necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: [satsuma@chembio.nagoya-u.ac.jp](mailto:satsuma@chembio.nagoya-u.ac.jp)

K. Sawabe : [sawabe@chembio.nagoya-u.ac.jp](mailto:sawabe@chembio.nagoya-u.ac.jp)

A. Oda : [akira@chembio.nagoya-u.ac.jp](mailto:akira@chembio.nagoya-u.ac.jp)



Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

### Course Purpose

In this course, we understand the phenomena at the interfaces in atomic and molecular scales and then design and fabricate effective photochemical or electrochemical systems.

Goals and objectives

1. To prepare materials having the sizes in a nanometer scale and then clarify their size-dependent physicochemical properties.
2. To fabricate energy conversion systems by the combination of various functional materials and to evaluate their efficiency.

We will learn the basic methods of photochemical and electrochemical preparation for energy conversion systems, and then obtain the abilities to analyze the experimental results qualitatively and quantitatively.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Characterization with electrochemical methods
2. Fabrication of solar cell
3. Preparation of photocatalysts
4. Designing functional materials through controlling nanostructures
5. Evaluation of photochemical and electrochemical properties

Please read the designated literature before starting each experiment.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations and reports. A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during the course, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	2 Spring and Autumn Semester
Lecturer	Koichi KIKUTA Professor

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#### Course Purpose

The aim of this course is to help students acquire an understanding of the fundamental principles of inorganic materials chemistry through the development of functional devices.

#### Prerequisite Subjects

#### Course Topics

#### Textbook

#### Additional Reading

#### Grade Assessment

#### Notes

#### Contacting Faculty

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	2 Spring and Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

In this special experiment and Exercise I, you will learn in detail the measurement principle of electron spin resonance equipment necessary for research in radiation chemistry, radiation biology, and photocatalytic chemistry. You will be able to prepare samples under the correct conditions and to analyze the obtained spectra correctly. Achievement target 1: You will be able to propose analysis methods according to experimental samples. Achievement 2: You will be able to measure the samples with the right conditions and analyze the spectra correctly.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. ESR measurement of organic radical and its spectrum analysis are performed. 2. ESR measurement of inorganic material and its spectrum analysis are performed. 3. ESR measurement and spectral analysis of cell-related samples are performed.

### Textbook

"Introduction to Electronic Spin Science & Technology", Supervised by the Society of Electron Spin Science and Technology, Yoneda Publishing.

### Additional Reading

Weil Bolton, "Electron Paramagnetic Resonance"

### Grade Assessment

You will be evaluated by both the experiment and analysis. On the experiments, it is important that whether the ESR measurement sample is properly adjusted and measured under the correct conditions (tuning of resonance state, microwave intensity, field modulation width, time constant, magnetic field sweep range) or not. On the analysis, it is important that whether you can simulate the experimental spectra with appropriate ESR parameters of g value, hyperfine coupling constants or not. Grading will be decided based on experimental performance (50%) and spectra simulation results (50%).

### Notes

Applicants who have completed the credits required to complete the master's course of Department of Applied Material Chemistry, Graduate School of Engineering, Nagoya University, or who are recognized as equivalent or higher.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Materials Chemistry	
Starts 1	1 Spring and Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

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### Course Purpose

The purpose of this experiment and practice is to deepen understanding of physical properties of nano-space materials such as crystal structure and gas adsorption, and conduct research based on original ideas and to acquire the ability of research skills by conducting synthesis, X-ray diffraction measurement and physical property measurement of nano-space materials.

Through these experiments and exercises, students will be able to acquire techniques for synthesizing, analyzing structures and measuring physical properties of nano-space materials based on metal complexes. In addition, it will be possible to conduct research on the development of nano-space materials with original ideas.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Synthesis experiments of nanoporous metal complexes  
Crystal structural analysis of nanoporous metal complexes  
Properties measurements of nanoporous metal complexes  
Gas adsorption measurements  
Research presentations for results and discussion

Study and understand the relevant literature before experiments and exercises. After the experiments and exercises, organize and analyze the data and give sufficient consideration.

### Textbook

Specify as appropriate as the progresses of this course.

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the progresses of this course.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations. Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

Take the designated safety training.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this experiment and exercise is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society.

By the end of this course, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, students will be able to deepen their understanding of the technologies required for the creation of ceramic/organic polymer materials in medicine (biomaterials) through experimental training and acquire research techniques on the synthesis and analysis of biomaterials.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Students will work on the following experiments and exercises.

1. Synthesis of ceramic materials
2. Synthesis of glass
3. Analysis of microstructure
4. Characterization and properties
5. Synthesis of proteins
6. Structural analysis of proteins

Students should make a plan for the safe experiments.

Students should review research papers that are provided in the course.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008.

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude and reports.

Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

### Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel inorganic nanomaterials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.



# Advanced Experiments and Exercises in Solid State Chemistry I (4.0credits) (固体化学特別実験及び演習 I)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	1 Spring and Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

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## Course Purpose

To understand the synthesis and characterization methods of various functional materials, and their applications. You can synthesize and evaluate low-dimensional materials and perform state of the art researches relating nanomaterials.

## Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics, Experimental safety science

## Course Topics

Experiments and discussion about

1. Synthesis of functional materials
2. Evaluation of functional materials
3. Application of functional materials

## Textbook

Experimental documents are distributed.

## Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

## Grade Assessment

The evaluation of learning results will be performed by the experimentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

## Notes

Not applicable.

## Contacting Faculty

Professors will answer the questions whenever required.

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Materials Chemistry	
Starts 1	2 Spring and Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this experiment and practice is to deepen understanding of physical properties of nano-space materials such as crystal structure and gas adsorption, and conduct research based on original ideas and to acquire the ability of research skills by conducting synthesis, X-ray diffraction measurement and physical property measurement of nano-space materials.

Through these experiments and exercises, students will be able to acquire techniques for synthesizing, analyzing structures and measuring physical properties of nano-space materials based on metal complexes. In addition, it will be possible to conduct research on the development of nano-space materials with original ideas.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Synthesis experiments of nanoporous metal complexes  
 Crystal structural analysis of nanoporous metal complexes  
 Properties measurements of nanoporous metal complexes  
 Gas adsorption measurements  
 Research presentations for results and discussion

Study and understand the relevant literature before experiments and exercises. After the experiments and exercises, organize and analyze the data and give sufficient consideration.

### Textbook

Specify as appropriate as the progresses of this course.

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the progresses of this course.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations. Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

Take the designated safety training.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this experiment and exercise is to develop the ability to discover new materials and new functions and to develop basic academic skills to solve the issues logically in the challenge of creating new materials that support a sustainable society. By the end of this course, students will understand the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, students will be able to deepen their understanding of the technologies required for the creation of ceramic/organic polymer materials in medicine (biomaterials) through experimental training and acquire research techniques on the synthesis and analysis of biomaterials.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Students will work on the following experiments and exercises. 1. Synthesis of glass-ceramics 2. Synthesis of organic-inorganic hybrids 3. Microstructure of glass-ceramics 4. Properties of the hybrids 5. Functional evaluation of proteins. Students should make a plan for the safe experiments. Students should review research papers that are provided in the course.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008. Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008. Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance. Contact information: Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp) Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp) Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Advanced Experiments and Exercises in Solid State Chemistry II (4.0credits) (固体化学特別実験及び演習 II)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Materials Chemistry
Starts 1	2 Spring and Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

To study on the techniques for eco-friendly manufacturing and functional improvement of the novel inorganic nanomaterials.

### Prerequisite Subjects

Microscopy, Spectroscopy, Inorganic Chemistry, Resource Chemistry, Environmental Chemistry, Physical Chemistry, Analytical Chemistry, Inorganic Reaction Chemistry

### Course Topics

Literature review of current research is made on the functional nano carbon and ceramics materials with discussion for development of appropriate treatments and process.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

### Grade Assessment

Students should understand important contents of solid-state materials chemistry. The evaluation is performed by examinations and reports. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020>A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.<Enrollees before 2019>S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

None specified.

### Contacting Faculty

Spontaneous questions from students are welcome. Discussions on the topics will be open to stimulate students for advanced research with broad view and deep insights.

# Advanced Experiments and Exercises in Solid State Chemistry II (4.0credits) (固体化学特別実験及び演習 II)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Materials Chemistry		
Starts 1	2 Spring and Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

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## Course Purpose

Following the Advanced Experiments and Exercises in Solid State Chemistry I, to understand the synthesis and characterization methods of functional materials, and their applications. You can synthesize and evaluate low-dimensional materials and perform state of the art researches relating nanomaterials.

## Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics, Experimental safety science  
Advanced Experiments and Exercises in Solid State Chemistry I

## Course Topics

Experiments and discussion about

1. Synthesis of functional materials
2. Evaluation of functional materials
3. Application of functional materials

## Textbook

Experimental documents are distributed.

## Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

## Grade Assessment

The evaluation of learning results will be performed by the experimentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

## Notes

Not applicable.

## Contacting Faculty

Professors will answer the questions whenever required.

## Innovation Practice Course (4.0credits) (イノベーション体験プロジェクト)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Under the instruction of the company engineer (DP, Directing Professor), I carry out the project for the problem solution by the team of several people consisting of different specialisms. In this way, it is intended to let you sense ability for problem discovery, the importance of the general intellectual power of compound eyes on the basis of real world bodily.

I know a point of view, the plan as the company and perform a discussion, exchange of opinions between the different specialty and aim for the breeding of the viewpoint general, to see engineering by examining it as the problem solution person concerned from different angles.

### Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

### Course Topics

I organize different specialty, the team (several/team) consisting of the students of the department several sets, and DP is the instruction in each each team. Based on the project theme that DP determined, I set the problem that a student carries out concretely. For 75 hours (principle one day a week), I accomplish the project for the problem solution.

Prior lecture to affect a project theme by the DP

Setting (opinion, information exchange, allied investigation, examination, discussion) of the concrete problem by the student

Enforcement of the problem solution project

Summary, report of the result

I assume this a main component.

In addition, I may be given an investigation and the consideration in conjunction with the theme as a problem from DP. Report it in a date (the next time lectures) when it was appointed, and announce it; and a thing corresponding to the exchange of opinions in the team.

#### Textbook

documents that a lecturer (DP) introduces it and shows.

#### Additional Reading

documents that a lecturer (DP) introduces it and shows.

#### Grade Assessment

I evaluate it through accomplishment, the discussion of the project, result announcement. If a consideration power, the adjustability for the problem solution, the expansion of the field of vision are accepted, it is said that I pass.

#### Notes

There are no prerequisites

#### Contacting Faculty

A lecturer (DP) and this project staff of the university accept questions at any time.



Research Internship 1 U2 (2.0credits) (研究インターンシップ 1 U2)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.

It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

### Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

### Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.

Orientation to affect the overall company concerned and the training medium

Enforcement (including cooperation, the adjustment with the company staff) of the training theme

Summary, report of the training result

I assume a report (presentation) of the training result to the university a main component.

As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

#### Textbook

documents that the staff instructing the training in the company introduces it and shows

#### Additional Reading

documents that the staff instructing the training in the company introduces it and shows

#### Grade Assessment

I am given in the following on 20th in the total days that engaged in the training in the company.

I do that I announce the result to the university in a result briefing session to perform after the training if essential.

I evaluate it based on result announcement contents and an evaluation book of the training staff making. I recognize an experience-based effect in the training by oneself, and will to plan reflection to a study, the study at the university does it with a pass if admitted.

#### Notes

The student that I subscribed for the training theme of the company, and acceptance was accepted.

#### Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship 1 U3 (3.0credits) (研究インターンシップ 1 U3)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.

It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

### Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

### Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.

Orientation to affect the overall company concerned and the training medium

Enforcement (including cooperation, the adjustment with the company staff) of the training theme

Summary, report of the training result

I assume a report (presentation) of the training result to the university a main component.

As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

#### Textbook

documents that the staff instructing the training in the company introduces it and shows

#### Additional Reading

documents that the staff instructing the training in the company introduces it and shows

#### Grade Assessment

The credits will be given to the students who have had the working days between 21 and 40 days in the internship company.

#### Notes

The student that I subscribed for the training theme of the company, and acceptance was accepted.

#### Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship 1 U4 (4.0credits) (研究インターンシップ1 U4)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.

It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

### Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

### Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.

Orientation to affect the overall company concerned and the training medium

Enforcement (including cooperation, the adjustment with the company staff) of the training theme

Summary, report of the training result

I assume a report (presentation) of the training result to the university a main component.

As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

#### Textbook

documents that the staff instructing the training in the company introduces it and shows

#### Additional Reading

documents that the staff instructing the training in the company introduces it and shows

#### Grade Assessment

The credits will be given to the students who have had the working days between 41 and 60 days in the internship company.

#### Notes

The student that I subscribed for the training theme of the company, and acceptance was accepted.

#### Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship 1 U6 (6.0credits) (研究インターンシップ 1 U6)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.

It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

**Prerequisite Subjects**

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

**Course Topics**

In the company accepting an intern, I make the training (study) about the study theme that a company shows.

Orientation to affect the overall company concerned and the training medium

Enforcement (including cooperation, the adjustment with the company staff) of the training theme

Summary, report of the training result

I assume a report (presentation) of the training result to the university a main component.

As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

#### Textbook

documents that the staff instructing the training in the company introduces it and shows

#### Additional Reading

documents that the staff instructing the training in the company introduces it and shows

#### Grade Assessment

The credits will be given to the students who have had the working days between 61 and 80 days in the internship company.

#### Notes

The student that I subscribed for the training theme of the company, and acceptance was accepted.

#### Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.



**Research Internship 1 U8 (8.0credits) (研究インターンシップ 1 U8)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.

It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

**Prerequisite Subjects**

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

**Course Topics**

In the company accepting an intern, I make the training (study) about the study theme that a company shows.

Orientation to affect the overall company concerned and the training medium

Enforcement (including cooperation, the adjustment with the company staff) of the training theme

Summary, report of the training result

I assume a report (presentation) of the training result to the university a main component.

As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

#### Textbook

documents that the staff instructing the training in the company introduces it and shows

#### Additional Reading

documents that the staff instructing the training in the company introduces it and shows

#### Grade Assessment

The credits will be given to the students who have had the working days more than or equal to 81 days in the internship company.

#### Notes

The student that I subscribed for the training theme of the company, and acceptance was accepted.

#### Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

## Laboratory Visit 1 U2 (2.0credits) (研究室ローテーション 1 U2)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Chemical Systems Engineering	Department of Energy Engineering	Department of Applied Energy
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

Up to 20 days research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Laboratory Visit 1 U3 (3.0credits) (研究室ローテーション 1 U3)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Chemical Systems Engineering	Department of Energy Engineering	Department of Applied Energy
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

21 days or more and 40 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Laboratory Visit 1 U4 (4.0credits) (研究室ローテーション 1 U4)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Chemical Systems Engineering	Department of Energy Engineering	Department of Applied Energy
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

41 days or more and 60 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Laboratory Visit 1 U6 (6.0credits) (研究室ローテーション 1 U6)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Chemical Systems Engineering	Department of Energy Engineering	Department of Applied Energy
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

61 days or more and 80 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Laboratory Visit 1 U8 (8.0credits) (研究室ローテーション 1 U8)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Chemical Systems Engineering	Department of Energy Engineering	Department of Applied Energy
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

81 days or more research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Ethics and Security in Engineering (2.0credits) (工学のセキュリティと倫理)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
	Department of Energy Engineering	Department of Applied Energy	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Tatsuya SUZUKI Professor		

### Course Purpose

The aim of the lecture is to understand ethics, intellectual property rights, information security required at the start of master thesis research. After taking this course, the students are expected to have abilities on:

1. Understanding of Ethics for engineers
2. Understanding of Ethics for researcher
3. Understanding of Intellectual property rights
4. Understanding of Information security

### Prerequisite Subjects

None because this is one of the common basic subject for future activity as a researcher or an engineer.

### Course Topics

- 1) Introduction,
- 2) Ethics for engineers,
- 3) Ethics for researchers,
- 4) Intellectual property rights,
- 5) Information security,
- 6) Summary

Submission of the report after each class is mandatory.

### Textbook

Instead of using textbook, original lecture notes will be provided at each class.

### Additional Reading

Original lecture notes will be provided at each class.



### Grade Assessment

Credits will be awarded to those students who score 'Pass' based on the reports and /or subjects given by each lecture.

### Notes

None because this is one of the common basic subject for future activity as a researcher or an engineer.

### Contacting Faculty

After each class student can ask in person.

Otherwise, contact to:

Pro. Suzuki

Ext. 2700, t\_suzuki@nuem.nagoya-u.ac.jp

## Seminar on medical engineering (2.0credits) (医工連携セミナー)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Materials Process Engineering	Chemical Systems Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Lecturer	Associated Faculty		

### Course Purpose

In the coming decades with growing overage population, novel technologies and outstanding ideas for the new breakthrough strategy of tailor-made medical therapy is strongly required. For the establishment of such strategy, basic technologies that enable the detection and diagnosis of molecular dynamics should be investigated. In this class, we try to educate young researchers to step out to this new frontier by setting various types of classes held by very advanced researchers in medical engineering field in Nagoya University. The lecturers are invited from engineering faculty and medical faculty, and introduce the expected ideas and the most recent achievements in the aspect of medical engineering.

1. Explain the importance of medical engineering research
2. Explain the outline of medical engineering research in Nagoya University
3. Explain the potential engineering ability needed for committing in medical engineering field

### Prerequisite Subjects

Clinical medicine, Molecular biology, Biological engineering, Biomechanics, Robotics, Medical engineering, Bioinformatics

### Course Topics

In every lecture, different lectures invited from different fields (engineer, doctors, etc.) teach the most recent advances in the field of medical engineering.

The following viewpoint will be focused

1. Propose the engineering techniques needed in clinical research or treatment
2. Propose the analytical methods for clinical research or treatment
3. Introduce the engineering techniques with high potency for clinical research

The lecture is mostly presented by power point, and for some classes, handouts are provided.

### Textbook

Not specified, but distributed handouts if necessary.

### Additional Reading

It will be appointed if necessary.

### Grade Assessment

Reports (80%) and interview (20%)

### Notes

Not needed

### Contacting Faculty

At lecture time

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Syusaku NAGANO Associate Professor		

### Course Purpose

To research in advanced engineering, it is necessary to learn the latest research trends through practice. Through symposium-style academic discussions, students will be able to study cutting-edge science and engineering research and discuss the latest trends in the subject areas.

### Prerequisite Subjects

Knowledge of the subject areas.

### Course Topics

Participated in special lectures set every year from the fields of biochemistry, analysis, semiconductors, polymers, and startups related to cutting-edge science and engineering, and participated in a symposium where research presentations on cutting-edge engineering were presented. By participating, students will study cutting-edge science and engineering research and discuss the latest trends in the subject areas. After taking the course, study and study the relevant field in detail.

### Textbook

Distribute as appropriate.

### Additional Reading

Distribute as appropriate.

### Grade Assessment

Report. A score of 60 or more out of 100 will be passed. Pass if you have a broad understanding of the subject area. Highly appreciate the point of contact with your own research, new business and research

proposals.

#### Notes

There are no special requirements. Students who are interested in startups are preferred.

#### Contacting Faculty

Arranging the schedules by e-mail and etc.

Advanced Experiments for Frontier Technologies and Sciences (1.0credits) (最先端理工学実験)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Experiment		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Syusaku NAGANO Associate Professor		

### Course Purpose

To research in advanced engineering, it is necessary to learn the latest research trends through practice. The purpose of this experiment is to find the research issues on one's own and conduct research experiments using the latest experimental equipment and molecular simulation technology.

Through this experiment, you will be able to understand the principles of the Raman spectrometer, ionization potential measurement, X-ray diffraction etc. and molecular simulation software and learn how to use them practically. The goal is to comprehensively acquire the knowledge, skills, and presentation techniques related to advanced experiments necessary for conducting the research that was the subject.

### Prerequisite Subjects

it is advisable to acquire basic knowledge on the subject research.

### Course Topics

When students choose the prepared subject, students perform the curriculum using one of a Raman spectrometer, an ionization potential measurement and an X-ray diffractometer and learn the principles and practical and advanced usage of these equipment. In the case of an experiment proposed by students (original experiment), students proposes a molecular simulation experiment or research using the above-described equipment, and conduct the experiment with the instructor to produce results. Ultimately, students discuss the results, present their results, and learn how to use the advanced equipment and simulation skills.

### Textbook

Distribute as needed. Please check the required documents by yourself.

### Additional Reading

Distribute as needed. Please check the required documents by yourself.

### Grade Assessment

Exercise (50%) and presentation of research results (50%) will be evaluated. Understanding the measurement principle and usage is used as a criterion for acceptance, but the research achievements and new approaches to research are highly evaluated. A score of 60 or more out of 100 is a passing score.

### Notes

No course requirements.

### Contacting Faculty

Arranging the schedules by e-mail and etc.

Introduction to Academic Communication (1.0credits) (コミュニケーション学)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Graduate Chemistry
	Graduate Chemistry	Automotive Engineering	Automotive Engineering
	Civil and Environmental Engineering Graduate		
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester		
Lecturer	ReikoFURUYA Associate Professor		

**Course Purpose**

Students will learn presentation skills for academic purposes, which may include giving academic presentations.

Japanese students are expected to present in English and international students in Japanese in the seventh or eighth class meeting.

By taking this class, students are expected to be able to do the following:

- Give a solid presentation with confidence and without hesitation
- Grasp the characteristics of successful presentations
- Use techniques learned in class in their own presentation

**Prerequisite Subjects**

English language classes for Japanese students

Japanese language classes for international students

**Course Topics**

- (1) Ways to convey messages in presentation
- (2) The language of a presentation
- (3) Tips for making effective slides
- (4) Observation and analysis of video-taped presentation by a past student
- (5) Paper vs presentation
- (6) Preparation for individual presentation
- (7) Individual presentations I

(8) Individual presentations

This course requires students to work outside of the classes for individual presentation.

**Textbook**

Handouts will be distributed in class

**Additional Reading**

1The Japan Times

2:

**Grade Assessment**

Individual presentation: 50%

Active class participation: 50%

Grades: A+: 100%-95%, A: 94%-80%, B: 79%-70%, C: 69%-65%, C-: 64%-60%, F: 59%-0%

Grading will be decided based on the ability to give an effective academic presentation.

**Notes**

There are no requirements for taking this class.

**Contacting Faculty**

Questions will be answered before class, in class, after class or by e-mail.



Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Automotive Engineering
	Automotive Engineering		
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
Lecturer	Yukio ISHIDA Designated Professor		

### Course Purpose

This course is intended to study the latest advanced technology of automobile engineering from top researchers of universities and industries. The topics of lectures are related to almost all fields of automotive industries, such as hybrid cars, electric cars, automated driving and crash safety. It is also intended to develop the English hearing/speaking ability. The attainment targets are as follows:

1. Understand the latest technology of automotive engineering.
2. Understand company's automotive production system.
3. Improve English ability in the field of science and engineering.
4. Strengthen communication skills and presentation skills in English by studying with international students.

### Prerequisite Subjects

lectures related to fundamental physics, mechanical, electrical and information engineering.

### Course Topics

#### A. Lectures

1. The Car Industry, Market Trend, Circumstance and Its Future.
2. Overview of Automotive Development Process.
3. Observation and Evaluation of Drivers' Behavior Perspective.
4. Car Materials and Processing.
5. Movements and Control of a Car.
6. Safety Engineering for the Prevention of Accidents.
7. Crash Safety.
8. Automobile Embedded Computing System.
9. Wireless Technologies in ITS.

- 10.Applications of CAE to Vehicle Development.
- 11.Energy Saving Technology for Automobiles.
- 12.Automated Driving.
- 13.Traffic Flow Characteristics.
- 14.Cars and Roads in Urban Transportation Context.
- 15.Automobile in Aging Society.

#### B. Factory Visits

- 1.Toyota Motors Corp., 2. Mitsubishi Motors Corp., 3. Toyota Boshoku Corp., 4.Suzuki Museum,
- 5.Toyota Commemorative Museum, 6. Traffic Safety and Environmental Lab.

#### C. Group Research Project

Several students form one group and each group selects one topic. They investigate and discuss about this topic and make presentations.

After each lecture is finished, read the handout and write a report about each lecture with your comments.

#### Textbook

Handout delivered in each lecture

#### Additional Reading

Introduced in the lectures

#### Grade Assessment

Evaluation will be based on (a) Discussions in the lectures 20%, (b) report for each lecture 20%, (c) group presentation 30%. and (d) report on research subject 30%. It is necessary to attend factory visits. In each item, the understanding of the concepts is especially evaluated.

Summing up the all scores from (a) to (d) and the students with evaluation A, B, or C can pass this subject.

#### Notes

1. There are limits of enrollment capacity. Full course student limit is about 10. Auditor limit for each lecture is about 10.
2. English ability is checked before accepted as a student.

#### Contacting Faculty

Mainly accepted during each lecture. Other general questions are accepted by Professor Yukio Ishida.

<Contact> TEL: 052-747-6797, Email: ishida@nuem.nagoya-u.ac.jp

**Advanced Lectures on Scientific English (1.0credits) (科学技術英語特論)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Automotive Engineering
	Automotive Engineering	Civil and Environmental Engineering Graduate	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Lecturer	Part-time Faculty		

**Course Purpose**

This is a course to acquire basic skills to summarize research as a paper in English. By the end of the course, students will be able to ...

- explain the basic structure of science and technology research paper
- list essential components of each section of research paper
- type short multiple-paragraph essays with appropriate punctuation
- orally express logically structured opinion

**Prerequisite Subjects**

Various subjects relating to English

**Course Topics**

1. Basics of academic writing in English (1)
2. Basic structure of science & technology research paper (1)
3. Writing (1), feedback and opinion exchange
4. Basics of academic writing in English (2)
5. Basic structure of science & technology research paper (2)
6. Writing (2), feedback and opinion exchange
7. Basic structure of science & technology research paper (3)
8. Writing (3), feedback and opinion exchange

Students are expected to spend a few hours each week reviewing key points of the lecture and working on the writing assignment.

**Textbook**

None. Students will receive handouts in each class session.

### Additional Reading

Glasman-Deal, H. (2010). Science Research Writing For Non-Native Speakers of English. Imperial College Press.

Swales, J.M. & Feak, C.B. (2012). Academic Writing for Graduate Students. The University of Michigan Press.

Wallwork, A. (2013). English for Academic Research: Grammar, Usage and Style. Springer.

Wallwork, A. (2016). English for Writing Research Papers. Springer.

### Grade Assessment

Submitting three short writing assignments that show understanding of research paper structure with appropriate punctuation is required for a passing grade. Speaking English contributing to discussion and opinion exchange, as well as raising questions in class, is strongly encouraged.

### Notes

There are no prerequisites

### Contacting Faculty

Email address to be announced in the first class

Focus on Venture Business I (2.0credits) (ベンチャービジネス特論 )

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Lecturer	Syusaku NAGANO Associate Professor		

### Course Purpose

People often point out that the layer of startup companies should assume the leading edge is thin. Part of the cause depends on the system, but in many cases, it is due to the difference in perceptions of the entrepreneurship between East and Western researchers. In this course, you study the basic knowledge and goals required as engineers and researchers when commercializing/starting a “university research.” We will show examples of technology development and commercialization based on research results of universities, entrepreneurship in companies and venture startups, and consider venture business utilizing research. Through this lecture, entrepreneurs' mindsets will be formed as well as minimum knowledge of patents.

### Prerequisite Subjects

### Course Topics

### Textbook

Distribute materials as appropriate.

### Additional Reading

### Grade Assessment

Evaluate based on self-made problem report Understanding the problems and solutions for startups that respond to the problems in the lecture is a criterion for success. The contents of the report are comprehensively evaluated, and a score of 60 or more is considered acceptable. New business proposals will be appreciated.

### Notes

Do not have any special requirements. We hope students who are interested in startups.

### Contacting Faculty

the break after the lecture.

Focus on Venture Business II (2.0credits) (ベンチャービジネス特論 )

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Lecturer	Syusaku NAGANO Associate Professor	Akitoshi EDAGAWA Visiting Professor	

**Course Purpose**

By referring to the examples of commercialization, in-company entrepreneurship and venture entrepreneurship given in the special lecture on venture business I, you study the specialized knowledge necessary for entrepreneurship and start-up from a public accountant, SME consultant, etc. Talks are held with specialists in Japan to acquire the knowledge needed for venture business management.

**Prerequisite Subjects**

**Course Topics**

**Textbook**

**Additional Reading**

**Grade Assessment**

**Notes**

**Contacting Faculty**

## Internship A (1.0credits) (学外実習 A)

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Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Materials Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Associated Faculty

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### Course Purpose

The objective of this lecture is that students become a researcher/engineer who can create and drive the next generation of "engineering and technology", and combines expertise as well as comprehensiveness with an international perspective. As an internship, he/she will perform employment experience related to his/her major and future career for a certain period of time. Under the supervising of the receiving company, we learn the experience in the necessity of learning socially-accepted idea and learn how academics are related. Besides, we confirm the mental attitude for going to society and cultivate the ability of creation with knowledge and wisdom learned at universities and graduate schools.

### Prerequisite Subjects

Chemistry, Physics, Biology, your major subjects

### Course Topics

The content varies depending on the situation of each receiving company. As an example, there are the following contents. 1. Safety education 2. Visit factory/laboratory 3. Understanding the background of the research purpose at factories/laboratories 4. Experiments, simulations, etc. on specific themes 5. Meeting on reviewing research progress 6. Meeting on accomplishment report on own themes

### Textbook

Whether textbook is needed or not depending on the situation of each hosting company.

### Additional Reading

Whether reference is needed or not depending on the situation of each hosting company.

### Grade Assessment

Attendance record and reports, and pass 60 points or more out of 100

### Notes

Course conditions and notes vary depending on the situation of each hosting company.

### Contacting Faculty

Please contact the internship instructor or your supervisor.

## International Cooperative Research Project U2 (2.0credits) (国際共同研究 U2)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

### Course Purpose

The purpose of this international project is to develop young researchers who have comprehensive and international abilities and can play an active role internationally.

Through this project, students will be able to

- 1) make an original research plan and perform it.
- 2) communicate and discuss with other foreign researchers in English fluently.
- 3) enhance their research and presentation skills.

### Prerequisite Subjects

Basic engineering classes, English, Technical English

### Course Topics

Experience R & D at overseas research institutes as follows.

- 1) Set a research theme and make a research plan based on discussions with overseas supervisors and conduct research.
- 2) Present your research results in English at your place of stay and discuss.
- 3) After returning to Japan, report the contents of research activities to the supervisor and receive comprehensive evaluation.

### Textbook

Will be designated by the supervisor in the visiting university (or research group).

### Additional Reading

Will be designated by the supervisor in the visiting university (or research group).

### Grade Assessment

Receive the evaluation of the instructor in your stay regarding the theme setting, research ability, and discussion method at the joint research destination. After returning to Japan, submit and present a report to the supervisor of the University. If the above results are comprehensively evaluated and it is deemed that sufficient research achievement ability has been acquired, the credits will be awarded.

### Notes

Credits will be given based on the period that the student studied at the visiting university (or research group).

[U2]2.0 credits: Period of students' stay: less than 20 days.

### Contacting Faculty

Ask to the supervisors in Nagoya university and visiting research group.



**International Cooperative Research Project U3 (3.0credits) (国際共同研究 U3)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

**Course Purpose**

The purpose of this international project is to develop young researchers who have comprehensive and international abilities and can play an active role internationally. Through this project, students will be able to 1) make an original research plan and perform it. 2) communicate and discuss with other foreign researchers in English fluently. 3) enhance their research and presentation skills.

**Prerequisite Subjects**

Basic engineering classes, English, Technical English

**Course Topics**

Experience R & D at overseas research institutes as follows. 1) Set a research theme and make a research plan based on discussions with overseas supervisors and conduct research. 2) Present your research results in English at your place of stay and discuss. 3) After returning to Japan, report the contents of research activities to the supervisor and receive comprehensive evaluation.

**Textbook**

Will be designated by the supervisor in the visiting university (or research group).

**Additional Reading**

Will be designated by the supervisor in the visiting university (or research group).

**Grade Assessment**

Receive the evaluation of the instructor in your stay regarding the theme setting, research ability, and discussion method at the joint research destination. After returning to Japan, submit and present a report to the supervisor of the University. If the above results are comprehensively evaluated and it is deemed that sufficient research achievement ability has been acquired, the credits will be awarded.

**Notes**

The grading will be based on the evaluation of the supervisor at the joint research group, and the reports and presentations after their return to Japan. [U3] 3.0 credits: Period of students' stay: From 21 days to 40 days

**Contacting Faculty**

Ask to the supervisors in Nagoya university and visiting research group.

## International Cooperative Research Project U4 (4.0credits) (国際共同研究 U4)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

### Course Purpose

The purpose of this international project is to develop young researchers who have comprehensive and international abilities and can play an active role internationally.

Through this project, students will be able to

- 1) make an original research plan and perform it.
- 2) communicate and discuss with other foreign researchers in English fluently.
- 3) enhance their research and presentation skills.

### Prerequisite Subjects

Basic engineering classes, English, Technical English

### Course Topics

Experience R & D at overseas research institutes as follows.

- 1) Set a research theme and make a research plan based on discussions with overseas supervisors and conduct research.
- 2) Present your research results in English at your place of stay and discuss.
- 3) After returning to Japan, report the contents of research activities to the supervisor and receive comprehensive evaluation.

### Textbook

Will be designated by the supervisor in the visiting university (or research group).

### Additional Reading

Will be designated by the supervisor in the visiting university (or research group).

### Grade Assessment

Receive the evaluation of the instructor in your stay regarding the theme setting, research ability, and discussion method at the joint research destination. After returning to Japan, submit and present a report to the supervisor of the University. If the above results are comprehensively evaluated and it is deemed that sufficient research achievement ability has been acquired, the credits will be awarded.

### Notes

Credits will be given based on the period that the student studied at the visiting university (or research group).

[U4]4.0 credits: Period of students' stay: more than 41 days.

### Contacting Faculty

Ask to the supervisors in Nagoya university and visiting research group.

**Overview of space exploration and research (2.0credits) (宇宙研究開発概論)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester		
Lecturer	Leading Graduate		

**Course Purpose**

This lecture course helps students to acquire a wide-ranging, panoramic knowledge of space research and development given by variety of lecturers from different academic fields.

**Prerequisite Subjects**

Basic mathematics, Basic physics

**Course Topics**

1. Space Exploration Projects
  - 1.1 Overview of Space Exploration and Research
  - 1.2 Space Projects
  - 1.3 International Satellite and Spacecraft (HTV) Development
  - 1.4 Project Management/Systems Engineering
  - 1.5 Intellectual Properties in Business
  
2. Space Explorations on Observations
  - 2.1 Space Propulsion Engineering
  - 2.2 Materials Development for Space Applications
  - 2.3 Space Observation Technologies
  - 2.4 Introduction to Radiation Detectors and Electronics
  
3. Space-related Science
  - 3.1 Foundations of Astrophysics
  - 3.2 Earth and Planetary Science
  - 3.3 Space Environment Science
  - 3.4 Simulation Experiments

Report subject will be given at every lecture. The report should be submitted by the given deadline.

### Textbook

We do not specify the textbook. Lecture notes will be given as necessary.

### Additional Reading

Recommended readings will be give during lectures as necessary.

### Grade Assessment

Report must be submitted for each lecture. Proper understanding of each lecture's contents is evaluated.

Passing average point is 60 out of 100.

### Notes

Students in "Leadership program for Space exploration and Research" are required to take this course before the qualifying examination. This course is open to any graduate students in Nagoya University.

### Contacting Faculty

Inquire contact method from the lecturer after the lecture

**Advanced Mobility Program Basic Course (4.0credits) (先進モビリティ学基礎)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture and Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Lecturer	Faculty of Advanced Mobility Program		

**Course Purpose**

To train students who can be active in the mobility industry or research institute. This course is aiming to cultivate comprehensive knowledge not only on specialized technical elements but also service and social impact of the mobility. The class will be provided not only by professors but also by engineers in industry. The course is organized as follows:

1. Understand fundamentals of automobile
2. Understand the trend on electrification of automobile
3. Understand the trend on intelligence for automobile
4. Understand dependability, safety and human factor
5. Comprehensively study the mobility service
6. Comprehensively study the legal system for mobility

**Prerequisite Subjects**

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

**Course Topics**

1. Fundamentals of automobile
2. Electrification of automobile
3. Intelligence for automobile
4. Dependability, safety and human factor
5. Mobility service
6. Legal system for mobility
7. Discussion and presentation

Read carefully the textbook before attending each class. After each class, solving the exercises in the

textbook is highly recommended. Submission of the report after each class is mandatory.

#### Textbook

Original lecture note will be provided.

#### Additional Reading

It will be announced in the class if necessary.

#### Grade Assessment

Evaluation is based on total score of reports at each class and final presentation. You need more than mark of 60 out of 100 points. Special certificate will be provided for passed students.

#### Notes

No particular requirement.

#### Contacting Faculty

Office hour: Wed. 13:00-14:00 @ Green Vehicle Material Research Building 1F

Mail to: o\_shimizu@nuem.nagoya-u.ac.jp

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise and Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Faculty of Advanced Mobility Program		

### Course Purpose

To train students who can be active in the mobility industry or research institute. This course is aiming to realization of autonomous drive by using 1/10 model car. Students develop the software system for autonomous driving. The course is organized as follows:

1. Understand architecture of autonomous drive
2. Understand the image processing for lane detection, and its implementation
3. Understand the control technique for lane following and its implementation

### Prerequisite Subjects

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

### Course Topics

This course is aiming to realization of autonomous drive by using 1/10 model car. Students develop the software system for autonomous driving. The course is organized as follows:

1. Architecture of autonomous drive
2. Image processing for lane detection, and its implementation
3. Control technique for lane following and its implementation

Class is performed based on group activity.

### Textbook

Original lecture note will be provided.

### Additional Reading

It will be announced in the class if necessary.

### Grade Assessment

Evaluate based on attendance at lecture, total score of tasks set at each time, final presentation. Special certificate will be provided for passed students.

### Notes

No particular requirement

### Contacting Faculty

Office hour:Wed.13:00-14:00 @Green Vehicle Material Research Building 1F

Mail to: o\_shimizu@nuem.nagoya-u.ac.jp



Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise and Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Faculty of Advanced Mobility Program		

### Course Purpose

To train students who can be active in the mobility industry or research institute. This course is aiming to design and analysis of EV formula car. In addition, Test drive is carried out. The course is organized as follows:1. Understand the mechanism of electric vehicle2. Understand the characteristics of motor and battery3. Understand the way of analysis and design of vehicle

### Prerequisite Subjects

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

### Course Topics

This course is aiming to design and analysis of EV formula car. In addition, Test drive is carried out. The course is organized as follows:1. Mechanism of electric vehicle2. Characteristics of motor and battery3. Way of analysis and design of vehicle Class is performed based on group activity.

### Textbook

Original lecture note will be provided.

### Additional Reading

It will be announced in the class if necessary.

### Grade Assessment

Evaluate based on attendance at lecture, total score of tasks set at each time, final presentation. You need more than mark of 60 out of 100 points. Special certificate will be provided for passed students.

### Notes

No particular requirement

### Contacting Faculty

Office hour:Wed.13:00-14:00 @Green Vehicle Material Research Building 1FMail to:  
o\_shimizu@nuem.nagoya-u.ac.jp

International research project U2 (2.0credits) (国際プロジェクト研究 U2)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

**Course Purpose**

- To design and conduct an original research project
- To develop experience with experimental/numerical/theoretical techniques
- To develop a working knowledge of relevant research literature
- To practice scientific writing and participate in the peer review process
- To be able to discuss the research and topic with other scientists and engineers

The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

**Prerequisite Subjects**

Basic engineering subjects, English, Technical English

**Course Topics**

- Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
- Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
- Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
- Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.

- Students are encouraged to present research results at appropriate scientific meetings.
- Students will be self-motivated and work independently, approaching the instructor for guidance regularly.

#### Textbook

Will be designated by each supervisor.

#### Additional Reading

Will be designated by each supervisor.

#### Grade Assessment

The grade will be calculated according to the following criteria.

Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.

The acceptance standard is to understand the introduced research approaches and ideas.

Evaluation is done by the supervisor(s) at home and visiting universities.

#### Notes

No conditions for taking the course

#### Contacting Faculty

Supervisor of visiting university basically takes care.

International research project U3 (3.0credits) (国際プロジェクト研究 U3)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

- To design and conduct an original research project
- To develop experience with experimental/numerical/theoretical techniques
- To develop a working knowledge of relevant research literature
- To practice scientific writing and participate in the peer review process
- To be able to discuss the research and topic with other scientists and engineers

The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

### Prerequisite Subjects

Basic engineering subjects, English, Technical English

### Course Topics

- Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
- Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
- Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
- Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.

- Students are encouraged to present research results at appropriate scientific meetings.
- Students will be self-motivated and work independently, approaching the instructor for guidance regularly.

#### Textbook

Will be designated by each supervisor.

#### Additional Reading

Will be designated by each supervisor.

#### Grade Assessment

The grade will be calculated according to the following criteria.

Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.

The acceptance standard is to understand the introduced research approaches and ideas.

Evaluation is done by the supervisor(s) at home and visiting universities.

#### Notes

No conditions for taking the course

#### Contacting Faculty

Supervisor of visiting university basically takes care.

International research project U4 (4.0credits) (国際プロジェクト研究 U4)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

- To design and conduct an original research project
- To develop experience with experimental/numerical/theoretical techniques
- To develop a working knowledge of relevant research literature
- To practice scientific writing and participate in the peer review process
- To be able to discuss the research and topic with other scientists and engineers

The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

### Prerequisite Subjects

Basic engineering subjects, English, Technical English

### Course Topics

- Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
- Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
- Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
- Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.

- Students are encouraged to present research results at appropriate scientific meetings.
- Students will be self-motivated and work independently, approaching the instructor for guidance regularly.

#### Textbook

Will be designated by each supervisor.

#### Additional Reading

Will be designated by each supervisor.

#### Grade Assessment

The grade will be calculated according to the following criteria.

Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.

The acceptance standard is to understand the introduced research approaches and ideas.

Evaluation is done by the supervisor(s) at home and visiting universities.

#### Notes

No conditions for taking the course

#### Contacting Faculty

Supervisor of visiting university basically takes care.

International special lecture (1.0credits) (国際協働教育特別講義)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester		
Lecturer	Associated Faculty		

**Course Purpose**

Gain basic knowledge of general engineering through English lectures on various hot research topics and leading technologies. The objective of this lecture is to develop research abilities and communication skills, which are essential to carry out international collaborative researches.

**Prerequisite Subjects**

Basic engineering subjects, English, Technical English

**Course Topics**

Depends on the lecturer. This course will be divided in 4 chapters as follows: 1. Setting theme and reviewing literature 2. Designing research plan 3. Analysis and discussion of results 4. Brief summary and future prospects Homework will be given after the class and the report is required to be submitted in next class.

**Textbook**

Will be designated by the lecturer.

**Additional Reading**

Will be designated by the lecturer.

**Grade Assessment**

Written report and evaluation by the professors.

**Notes**

No conditions for taking the course

**Contacting Faculty**



In the class and E-mail.

**International language exercise (1.0credits) (国際協働教育外国語演習)**

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester		
Lecturer	Associated Faculty		

**Course Purpose**

The aim of this course is to provide Japanese students with the English classes or provide international students with Japanese classes to improve communication skills for both academic and daily life.

**Prerequisite Subjects**

English, Technical English, Japanese

**Course Topics**

Wide variety of exercises including speaking, listening, writing, reading, and presentation in Japanese/English. Homework will be given after the class and the report is required to be submitted in next class.

**Textbook**

Will be designated by the lecturer.

**Additional Reading**

Will be designated by the lecturer.

**Grade Assessment**

Report, presentation, participation in discussion Grading will be based on understanding Japanese and English, and communication performance.

**Notes**

No conditions for taking the course

**Contacting Faculty**

Acceptance and response in the class or through E-mail.

## Seminar on Applied Physical Chemistry 2A (2.0credits) (応用物理化学セミナー 2A)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry, Basic Physical Chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 2A (2.0credits) (応用物理化学セミナー 2A)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Spring Semester	
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

In this seminar, we will develop researchers and engineers who have the ability to create and lead the next generation of "engineering and technology" and combine rich expertise with advanced comprehensiveness and a broad international perspective. We aim to improve our internationality, leadership, and connection with society in our specialized fields. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined mainly from the following topics, considering the latest scientific trends and the progress in research of each student. 1 Analysis of catalytic reactions by reaction kinetics 2 Understanding catalytic reactions by thermodynamics and quantum chemistry 3 Basics and applications of spectroscopy 4. Solid surface phenomena 5. Basics and applications of industrial catalysts 6 Resources and energy chemistry 7 Topics in catalytic chemistry and material chemistry Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions. Speakers must prepare reports before their presentations. (Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry and Inorganic Chemistry for graduate students are necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address. A. Satsuma: satsuma@chembio.nagoya-u.ac.jp K. Sawabe : sawabe@chembio.nagoya-u.ac.jp A. Oda : akira@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2A (2.0credits) (応用物理化学セミナー 2A)

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Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in the size range from atom scale to nanometer scale and then obtain skills to design and fabricate efficient energy conversion systems using well-organized materials.

Goals and objectives

1. To understand the physicochemical properties of metal and semiconductor nano-materials and to explain their changes depending on the sizes.
2. To design novel efficient energy conversion systems by combining reported phenomena and original ideas.

Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to quantitatively evaluate the efficiency of these systems.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2A (2.0credits) (応用物理化学セミナー 2A)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 2A (2.0credits) (応用物理化学セミナー 2A)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course. Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly. Achievement target2: You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly. 2. By the day of your literature introduction, read a paper related to your doctor's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents. 3. You propose ideas to advance your doctor's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks. You can select papers should be read and introduced according to your doctoral thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluate the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants who have completed the credits required to complete the master's course of Department of Applied Material Chemistry, Graduate School of Engineering, Nagoya University, or who are recognized as equivalent or higher.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp



## Seminar on Applied Physical Chemistry 2B (2.0credits) (応用物理化学セミナー 2B)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	ShinodaWataru Associate Professor    Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry, Basic Physical Chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 2B (2.0credits) (応用物理化学セミナー 2B)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Autumn Semester	
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

In this seminar, we will develop researchers and engineers who have the ability to create and lead the next generation of "engineering and technology" and combine rich expertise with advanced comprehensiveness and a broad international perspective. We aim to improve our internationality, leadership, and connection with society in our specialized fields. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined mainly from the following topics, considering the latest scientific trends and the progress in research of each student. 1 Analysis of catalytic reactions by reaction kinetics 2 Understanding catalytic reactions by thermodynamics and quantum chemistry 3 Basics and applications of spectroscopy 4. Solid surface phenomena 5. Basics and applications of industrial catalysts 6 Resources and energy chemistry 7 Topics in catalytic chemistry and material chemistry Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions. Speakers must prepare reports before their presentations. (Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry and Inorganic Chemistry for graduate students are necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address. A. Satsuma: satsuma@chembio.nagoya-u.ac.jp K. Sawabe : sawabe@chembio.nagoya-u.ac.jp A. Oda : akira@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2B (2.0credits) (応用物理化学セミナー 2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

### Course Purpose

In this seminar, we understand the phenomena at the interfaces in the size range from atom scale to nanometer scale and then obtain skills to design and fabricate efficient energy conversion systems using well-organized materials.

Goals and objectives

1. To understand the physicochemical properties of metal and semiconductor nano-materials and to explain their changes depending on the sizes.
2. To design novel efficient energy conversion systems by combining reported phenomena and original ideas.

Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to quantitatively evaluate the efficiency of these systems.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2B (2.0credits) (応用物理化学セミナー 2B)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course.

Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly.

Achievement target2: You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly.
2. By the day of your literature introduction, read a paper related to your doctor's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents.
3. You propose ideas to advance your doctor's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks.

You can select papers should be read and introduced according to your doctoral thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluate the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants must have completed credits that meet the master course graduation requirements of the Department of Chemistry and Biotechnology, Graduate school of Engineering, Nagoya University.

### Contacting Faculty

The instructor:

Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2C (2.0credits) (応用物理化学セミナー 2C)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry, Basic Physical Chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 2C (2.0credits) (応用物理化学セミナー 2C)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	2 Spring Semester	
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

In this seminar, we will develop researchers and engineers who have the ability to create and lead the next generation of "engineering and technology" and combine rich expertise with advanced comprehensiveness and a broad international perspective. We aim to improve our internationality, leadership, and connection with society in our specialized fields. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined mainly from the following topics, considering the latest scientific trends and the progress in research of each student. 1 Analysis of catalytic reactions by reaction kinetics 2 Understanding catalytic reactions by thermodynamics and quantum chemistry 3 Basics and applications of spectroscopy 4. Solid surface phenomena 5. Basics and applications of industrial catalysts 6 Resources and energy chemistry 7 Topics in catalytic chemistry and material chemistry Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions. Speakers must prepare reports before their presentations. (Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry and Inorganic Chemistry for graduate students are necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address. A. Satsuma: satsuma@chembio.nagoya-u.ac.jp K. Sawabe : sawabe@chembio.nagoya-u.ac.jp A. Oda : akira@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in the size range from atom scale to nanometer scale and then obtain skills to design and fabricate efficient energy conversion systems using well-organized materials.

Goals and objectives

1. To understand the physicochemical properties of metal and semiconductor nano-materials and to explain their changes depending on the sizes.
2. To design novel efficient energy conversion systems by combining reported phenomena and original ideas.

Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to quantitatively evaluate the efficiency of these systems.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp



## Seminar on Applied Physical Chemistry 2C (2.0credits) (応用物理化学セミナー 2C)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 2C (2.0credits) (応用物理化学セミナー 2C)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course. Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly. Achievement target2: You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly. 2. By the day of your literature introduction, read a paper related to your doctor's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents. 3. You propose ideas to advance your doctor's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks. You can select papers should be read and introduced according to your doctoral thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluated the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants who have completed the credits required to complete the master's course of Department of Applied Material Chemistry, Graduate School of Engineering, Nagoya University, or who are recognized as equivalent or higher.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2D (2.0credits) (応用物理化学セミナー 2D)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	ShinodaWataru Associate Professor      Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry, Basic Physical Chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 2D (2.0credits) (応用物理化学セミナー 2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Atsushi Satsuma Professor	Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

In this seminar, we will develop researchers and engineers who have the ability to create and lead the next generation of "engineering and technology" and combine rich expertise with advanced comprehensiveness and a broad international perspective. We aim to improve our internationality, leadership, and connection with society in our specialized fields. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary probl

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined mainly from the following topics, considering the latest scientific trends and the progress in research of each student.

- 1 Analysis of catalytic reactions by reaction kinetics
- 2 Understanding catalytic reactions by thermodynamics and quantum chemistry
- 3 Basics and applications of spectroscopy
4. Solid surface phenomena
5. Basics and applications of industrial catalysts
- 6 Resources and energy chemistry
- 7 Topics in catalytic chemistry and material chemistry

Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions.

Speakers must prepare reports before their presentations.

(Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry and Inorganic Chemistry for graduate students are necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address.

A. Satsuma: [satsuma@chembio.nagoya-u.ac.jp](mailto:satsuma@chembio.nagoya-u.ac.jp)

K. Sawabe : [sawabe@chembio.nagoya-u.ac.jp](mailto:sawabe@chembio.nagoya-u.ac.jp)

A. Oda : [akira@chembio.nagoya-u.ac.jp](mailto:akira@chembio.nagoya-u.ac.jp)

## Seminar on Applied Physical Chemistry 2D (2.0credits) (応用物理化学セミナー 2D)

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Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in the size range from atom scale to nanometer scale and then obtain skills to design and fabricate efficient energy conversion systems using well-organized materials. Goals and objectives 1. To understand the physicochemical properties of metal and semiconductor nano-materials and to explain their changes depending on the sizes. 2. To design novel efficient energy conversion systems by combining reported phenomena and original ideas. Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to quantitatively evaluate the efficiency of these systems.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods 2. Photoelectrochemistry 3. Solar cell 4. Photocatalysis 5. Designing functional materials through control of the nanostructure Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations. A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail. Contact address:  
torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2D (2.0credits) (応用物理化学セミナー 2D)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

Report and discussion

### Notes

### Contacting Faculty

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	Jun KUMAGAI Associate Professor

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### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course.

Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly.

Achievement target2:

You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly.
2. By the day of your literature introduction, read a paper related to your doctor's thesis research carefully,, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents.
3. You propose ideas to advance your doctor's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks.

You can select papers should be read and introduced according to your doctoral thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluated the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants who have completed the credits required to complete the master's course of Department of Applied Material Chemistry, Graduate School of Engineering, Nagoya University, or who are recognized as equivalent or higher.

### Contacting Faculty

The instructor:

Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp



## Seminar on Applied Physical Chemistry 2E (2.0credits) (応用物理化学セミナー 2E)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	3 Spring Semester
Lecturer	ShinodaWataru Associate Professor    Kazushi FUJIMOTO Assistant Professor

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### Course Purpose

Students read textbook, papers, and reviews related to theoretical and computational chemistry, and summarize them, and learn how to approach, proceed, and report the research work. In addition, by understanding of research trends in related fields, students are able to cultivate their basic skills, applied skills, creativity, comprehensive skills, and a broad perspective.

### Prerequisite Subjects

Thermodynamics, Quantum chemistry 1 and 2, Polymer physical chemistry, Energy and computational chemistry, Basic Physical Chemistry

### Course Topics

Themes will be selected from the students' research target and various issues related to theoretical and computational sciences and related fields that are expected to be issues in the future, and recent literature reviews and discussion exercises based on them will be conducted.

### Textbook

Not specified. Investigate appropriate textbooks and literature for the tasks set by each student.

### Additional Reading

Not specified, though related textbooks and papers will be introduced when needed.

### Grade Assessment

Evaluate the goal achievement level by oral presentation at the seminar and Q & A session.

### Notes

N/A

### Contacting Faculty

Accept and respond to the questions raised during the seminar.

## Seminar on Applied Physical Chemistry 2E (2.0credits) (応用物理化学セミナー 2E)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	3 Spring Semester	
Lecturer	Atsushi Satsuma Professor Kyoichi SAWABE Lecturer	Akira ODA Assistant Professor

### Course Purpose

In this seminar, we will develop researchers and engineers who have the ability to create and lead the next generation of "engineering and technology" and combine rich expertise with advanced comprehensiveness and a broad international perspective. We aim to improve our internationality, leadership, and connection with society in our specialized fields. In the lectures, we will improve our research skills based on basic studies. We read the relevant literature on solid catalysts, inorganic functional materials, material design on the crystal surface, and structural analysis and related fields, to make a review paper of the literature. We will learn how to summarize, how to deeply understand the research trends in related fields. We will acquire information gathering and organizing skills, basic and applied science skills, persuasive skills, and logical thinking skills. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to solid catalysts. We need to have quantitative skills, information literacy, logical thinking skills, problem solving skills, thinking skills, comprehensive use of knowledge, skills, attitudes, etc., and the ability to solve voluntary problems.

### Prerequisite Subjects

Catalysis, surface science, kinetics, thermodynamics, quantum chemistry, physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and related chemistry

### Course Topics

Lectures are conducted in a seminar. The topics will be determined mainly from the following topics, considering the latest scientific trends and the progress in research of each student. 1 Analysis of catalytic reactions by reaction kinetics 2 Understanding catalytic reactions by thermodynamics and quantum chemistry 3 Basics and applications of spectroscopy 4. Solid surface phenomena 5. Basics and applications of industrial catalysts 6 Resources and energy chemistry 7 Topics in catalytic chemistry and material chemistry Before the seminar, the member should prepare a review document for the topic, and explain in the lecture. Comprehension is confirmed through questions and discussions with participants.

### Textbook

Research papers, reviews, and books about related area.

### Additional Reading

Research papers, reviews, and books about related area.

### Grade Assessment

Report and oral presentation and discussions. Speakers must prepare reports before their presentations. (Evaluation criteria) A total score of 60/100 points or more will be accepted.

### Notes

Physical Chemistry and Inorganic Chemistry for graduate students are necessary.

### Contacting Faculty

Discussion after the class or e-mail to the following address. A. Satsuma: satsuma@chembio.nagoya-u.ac.jp K. Sawabe : sawabe@chembio.nagoya-u.ac.jp A. Oda : akira@chembio.nagoya-u.ac.jp

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	3 Spring Semester		
Lecturer	Tsukasa TORIMOTO Professor	Shushi SUZUKI Associate Professor	Tatsuya KAMEYAMA Assistant Professor

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### Course Purpose

In this seminar, we understand the phenomena at the interfaces in the size range from atom scale to nanometer scale and then obtain skills to design and fabricate efficient energy conversion systems using well-organized materials.

Goals and objectives

1. To understand the physicochemical properties of metal and semiconductor nano-materials and to explain their changes depending on the sizes.
2. To design novel efficient energy conversion systems by combining reported phenomena and original ideas.

Through these, we will understand basic photochemical and electrochemical concepts for the fabrication of energy conversion systems and then develop the skills to quantitatively evaluate the efficiency of these systems.

### Prerequisite Subjects

Physical Chemistry, Electrochemistry, Photochemistry, and Catalysis

### Course Topics

1. Electrochemical methods
2. Photoelectrochemistry
3. Solar cell
4. Photocatalysis
5. Designing functional materials through control of the nanostructure

Please read the designated parts of the textbook or documents before each class.

### Textbook

Textbooks will be notified at the beginning of this course.

### Additional Reading

Reference books will be notified at the beginning of this course.

### Grade Assessment

The evaluation of learning results will be carried out by oral examinations.

A passing score is 60/100.

### Notes

No course requirements are needed.

### Contacting Faculty

Discussion is welcome during and after the class, or with e-mail.

Contact address: torimoto@chembio.nagoya-u.ac.jp

## Seminar on Applied Physical Chemistry 2E (2.0credits) (応用物理化学セミナー 2E)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	3 Spring Semester
Lecturer	Koichi KIKUTA Professor

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### Course Purpose

The purpose of this course is to search and discuss on the novel inorganic materials and processing concerning on energy conversion. It is also aimed to learn how to apply these information to their own research.

### Prerequisite Subjects

Basic chemistry, Inorganic reaction chemistry, Inorganic materials chemistry, Analytical chemistry, Catalyst and surface chemistry

### Course Topics

Literature review of current research on solid oxide fuel cell, energy conversion, and energy reserve with discussion.

### Textbook

### Additional Reading

### Grade Assessment

### Notes

### Contacting Faculty

## Seminar on Applied Physical Chemistry 2E (2.0credits) (応用物理化学セミナー 2E)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	3 Spring Semester
Lecturer	Jun KUMAGAI Associate Professor

### Course Purpose

The aim of this course is to introduce various instrumental analysis methods (especially magnetic resonance spectroscopy) necessary for researches in radiation chemistry, radiation biology, and photocatalytic chemistry, by reading specialized books and by introducing related papers published in specialized journals. Exploring research trends in related fields is also the aim of this course. Achievement target1: You can provide appropriate analytical methods for your research materials and analyze the spectra correctly. Achievement target2: You will be able to make presentations that can correctly convey what you want to convey to others.

### Prerequisite Subjects

Quantum Chemistry 1 and Exercise, Quantum Chemistry 2 and Exercise, Thermodynamics 1 and Exercise, Thermodynamics 2 and Exercise, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise, Analytical Chemistry 3, Inorganic Chemistry 1, Exercise and Organic Chemistry 1 and Exercise

### Course Topics

1. You read related technical books, explain the contents to the instructor, and confirm that you understand correctly. 2. By the day of your literature introduction, read a paper related to your doctor's thesis research carefully, and summarize it in PowerPoint. Introduce the summarized contents to the instructor and students using PowerPoint and discuss the research contents. 3. You propose ideas to advance your doctor's thesis research, and discuss the proposals with the instructor and students.

### Textbook

The instructor selects textbooks. You can select papers should be read and introduced according to your doctoral thesis research.

### Additional Reading

Instructed during class as needed.

### Grade Assessment

Evaluated the degree of achievement of the goal by oral presentation at the seminar and Q & A session. Oral presentation and Q & A are 60% and 40%, respectively.

### Notes

Applicants who have completed the credits required to complete the master's course of Department of Applied Material Chemistry, Graduate School of Engineering, Nagoya University, or who are recognized as equivalent or higher.

### Contacting Faculty

The instructor: Jun Kumagai, Ph.D.; Associate Professor; Phone: 2591; Email: kumagai@imass.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 2A (2.0credits) (固体化学セミナー 2A)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Spring Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 2A (2.0credits) (固体化学セミナー 2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop ability to promote original research based on a broad perspective and advanced expertise in the challenge of creating new materials that support a sustainable society.

By the end of this seminar, students will gain advanced knowledge on the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, these knowledge can apply to discuss the technology necessary for the creation of materials in medicine (biomaterials), acquire research techniques for the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given.

1. General demands on biomaterials
2. Definitions of biomaterials and their properties
3. Definitions of ceramic materials and sintering behavior
4. Synthesis of ceramics
5. Microstructure and properties of ceramics
6. Synthesis of proteins by genetic engineering

Students should prepare materials necessary for discussion by the day of the seminar.

Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008.

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and

Physical Chemistry of Macromolecules.

**Contacting Faculty**

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)



## Seminar on Solid State Chemistry 2A (2.0credits) (固体化学セミナー 2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Spring Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

The lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

### Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 2A (2.0credits) (固体化学セミナー 2A)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Spring Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

Understanding of the studies on functional materials and training of how to establish the research thema for doctral thesis.

### Prerequisite Subjects

Seminar on Solid State Chemistry 1A-1D

### Course Topics

Design of nano-structured materials

### Textbook

Seminar documents are distributed. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition), Guozhong Cao and Ying Wang, World Scientific, 2010

### Additional Reading

### Grade Assessment

The evaluation of learning results will be performed by the presentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more. Grades are as follows: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

### Contacting Faculty

We have office hours after the seminar and accept questions about seminar contents.

## Seminar on Solid State Chemistry 2B (2.0credits) (固体化学セミナー 2B)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	1 Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 2B (2.0credits) (固体化学セミナー 2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop ability to promote original research based on a broad perspective and advanced expertise in the challenge of creating new materials that support a sustainable society.

By the end of this seminar, students will gain advanced knowledge on the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, these knowledge can apply to discuss the technology necessary for the creation of materials in medicine (biomaterials), acquire research techniques for the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given.

1. Phase diagram and formation of glass
2. Structure and properties of glass
3. Crystalization of liquid
4. Synthesis of glass-ceramics
5. Surface reaction of glass in body environment
6. Structure, properties and functions of biopolymers

Students should prepare materials necessary for discussion by the day of the seminar.

Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008.

Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008.

Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more.

Grades are as follows:

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and

Physical Chemistry of Macromolecules.

**Contacting Faculty**

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance.

Contact information:

Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)

Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp)

Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 2B (2.0credits) (固体化学セミナー 2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	1 Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following the Solid State Chemistry Seminar 2A, this lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics

Seminar on Solid State Chemistry 2A

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

### Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 2B (2.0credits) (固体化学セミナー 2B)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	1 Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

Understanding of the studies on functional materials and training of how to establish the research thema for doctral thesis.

### Prerequisite Subjects

Seminar on Solid State Chemistry 2A

### Course Topics

Synthesis of nano-structured materials

### Textbook

Seminar documents are distributed. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition), Guozhong Cao and Ying Wang, World Scientific, 2010

### Additional Reading

### Grade Assessment

The evaluation of learning results will be performed by the presentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more. Grades are as follows: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

### Contacting Faculty

We have office hours after the seminar and accept questions about seminar contents.

## Seminar on Solid State Chemistry 2C (2.0credits) (固体化学セミナー 2C)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	2 Spring Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanospace materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanospace materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp



## Seminar on Solid State Chemistry 2C (2.0credits) (固体化学セミナー 2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop ability to promote original research based on a broad perspective and advanced expertise in the challenge of creating new materials that support a sustainable society. By the end of this seminar, students will gain advanced knowledge on the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, these knowledge can apply to discuss the technology necessary for the creation of materials in medicine (biomaterials), acquire research techniques for the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given. 1. Analysis of reaction between glass and body fluid 2. Design of bioactive materials 3. Biomimetic processing Students should prepare materials necessary for discussion by the day of the seminar. Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008. Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008. Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance. Contact information: Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp) Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp) Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 2C (2.0credits) (固体化学セミナー 2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Spring Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following the Solid State Chemistry Seminar 2B, this lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics

Seminars on Solid State Chemistry 2A, 2B

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

### Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 2C (2.0credits) (固体化学セミナー 2C)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Spring Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

Understanding of the studies on functional materials and training of how to establish creative researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 2A, 2B

### Course Topics

Properties characterization of nano-structured materials

### Textbook

Seminar documents are distributed. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition), Guozhong Cao and Ying Wang, World Scientific, 2010

### Additional Reading

### Grade Assessment

The evaluation of learning results will be performed by the presentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more. Grades are as follows: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

### Contacting Faculty

We have office hours after the seminar and accept questions about seminar contents.

## Seminar on Solid State Chemistry 2D (2.0credits) (固体化学セミナー 2D)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	2 Autumn Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

The level of achievement to the goal will be evaluated in reports and presentations.

Pass if you understand the basics of inorganic and coordination compounds, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp

## Seminar on Solid State Chemistry 2D (2.0credits) (固体化学セミナー 2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop ability to promote original research based on a broad perspective and advanced expertise in the challenge of creating new materials that support a sustainable society. By the end of this seminar, students will gain advanced knowledge on the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, these knowledge can apply to discuss the technology necessary for the creation of materials in medicine (biomaterials), acquire research techniques for the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given. 1. Organic-inorganic hybrids 2. Hyperthermia with ceramic materials 3. Biomaterials for tissue regeneration Students should prepare materials necessary for discussion by the day of the seminar. Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008. Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008. Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance. Contact information: Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp) Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp) Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 2D (2.0credits) (固体化学セミナー 2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	2 Autumn Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following the Solid State Chemistry Seminar 2C, this lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained.

You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics

Seminars on Solid State Chemistry 2A, 2B, 2C

### Course Topics

1. Synthesis of functional materials
2. Properties of functional materials
3. Applications of functional materials

Discussion and debate are necessary.

Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

### Additional Reading

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

Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%).

Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials.

<Enrollees after 2020>

A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0.

<Enrollees before 2019>

S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 2D (2.0credits) (固体化学セミナー 2D)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	2 Autumn Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

Understanding of the studies on functional materials and training of how to establish creative researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 2A, 2B, 2C

### Course Topics

Microstructure analysis of nano-structured materials

### Textbook

Seminar documents are distributed. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition), Guozhong Cao and Ying Wang, World Scientific, 2010

### Additional Reading

### Grade Assessment

The evaluation of learning results will be performed by the presentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more. Grades are as follows: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

### Contacting Faculty

We have office hours after the seminar and accept questions about seminar contents.

## Seminar on Solid State Chemistry 2E (2.0credits) (固体化学セミナー 2E)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Materials Chemistry	
Starts 1	3 Spring Semester	
Lecturer	Ryoutarou MATSUDA Professor	Akihiro HORI Assistant Professor

### Course Purpose

The purpose of this course is to understand the basics, applications and the latest research on the synthesis, structure and function of nanoporous materials based on metal complexes.

By mastering this seminar, students will be able to explain the basic and advanced content related to the synthesis, structure and function of nanoporous materials based on metal complexes. Students will also gain knowledge about the latest research on nanoporous compounds in the world.

### Prerequisite Subjects

Inorganic Chemistry 1 with Exercises, Inorganic Chemistry 2 with Exercises, Chemistry of Inorganic Reaction, Chemistry of Inorganic Materials

### Course Topics

Chemistry of metal complexes  
Syntheses of nanoporous metal complexes  
Structures of nanoporous metal complexes  
Functions of nanoporous metal complexes  
Adsorption chemistry

Read the handouts before the seminar. After the seminar, deepen the knowledge of the related researches by reading papers introduced.

### Textbook

Specify as appropriate as the seminar progresses

### Additional Reading

Solid State Chemistry and its Applications, 2nd Edition, Wiley, Anthony R. West

Additionally, other books will be introduced as appropriate as the lecture progresses.

### Grade Assessment

Class participation, presentation and report:

Criteria score range for passing: 100-60

(S:100-90, A:89-80, B:79-70, C:69-60)

### Notes

The seminar will be held in Japanese or English.

### Contacting Faculty

Professors will answer questions in the lecture or professor's rooms.

Contact information:

Professor Ryotaro Matsuda

Tel:4603/ Email: ryotaro.matsuda@chembio.nagoya-u.ac.jp

Assistant Professor Akihiro Hori

Tel:5114/ Email: akihiro.hori@chembio.nagoya-u.ac.jp



## Seminar on Solid State Chemistry 2E (2.0credits) (固体化学セミナー 2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	3 Spring Semester		
Lecturer	Chikara OHTUKI Professor	Ayae Narutaki Professor	Jin NAKAMURA Assistant Professor

### Course Purpose

The purpose of this seminar is to develop ability to promote original research based on a broad perspective and advanced expertise in the challenge of creating new materials that support a sustainable society. By the end of this seminar, students will gain advanced knowledge on the biological functions of inorganic solid materials (ceramics) required for developing artificial bones and artificial teeth and organic polymer materials that contribute to tissue engineering. In addition, these knowledge can apply to discuss the technology necessary for the creation of materials in medicine (biomaterials), acquire research techniques for the development of biomaterials, and develop the imagination of material development.

### Prerequisite Subjects

Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, Physical Chemistry of Macromolecules

### Course Topics

Seminars on the following contents will be given. 1. Biomaterials and medicine 2. Biomaterials and ethics 3. Cooperative researches of materials science and medicine. Students should prepare materials necessary for discussion by the day of the seminar. Students should review the contents of the seminar by reading reference papers provided in the seminar.

### Textbook

Textbooks are not designated. Prints are distributed when necessary.

### Additional Reading

Bioceramics and their clinical applications, Ed. by T. Kokubo, Woodhead Publishing Limited, 2008. Bioceramics: Properties, Characterizations, and Applications, J. Park, Springer, 2008. Principles of Ceramics Processing, 2nd Edition, J. S. Reed, John Wiley and Sons, Inc. 1995.

### Grade Assessment

The evaluation of learning results will be performed by the participation attitude, oral presentation, and the answers to the questions. Credits will be awarded to those students who score 60 or more. Grades are as follows: <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

It is desirable for students to have basic knowledge of Inorganic Chemistry, Chemistry of Inorganic Reaction, Inorganic Material Chemistry, Thermodynamics, Analytical Chemistry, Biochemistry, and Physical Chemistry of Macromolecules.

### Contacting Faculty

Questions outside the hours are accepted in the lecture room or teachers' room after the seminar. Otherwise, contact the instructor by e-mail in advance. Contact information: Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp) Associate Professor Ayae Sugawara-Narutaki (ayae@chembio.nagoya-u.ac.jp) Assistant Professor Jin Nakamura (nakamura@chembio.nagoya-u.ac.jp)

## Seminar on Solid State Chemistry 2E (2.0credits) (固体化学セミナー 2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Materials Chemistry		
Starts 1	3 Spring Semester		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor

### Course Purpose

Following the Solid State Chemistry Seminar 2D, this lecture is based on seminar of low-dimensional functional material synthesis and their properties. Besides, presentation skill is also trained. You can learn fundamental concepts on synthesis and analysis ways of low-dimensional materials and perform state of the art nanomaterial researches.

### Prerequisite Subjects

Electron microscopy, Crystal diffractometry, Spectroscopy, Inorganic chemistry, Environmental chemistry, Analytical chemistry, Inorganic reaction chemistry, Crystal physics Seminars on Solid State Chemistry 2A, 2B, 2C, 2D

### Course Topics

1. Synthesis of functional materials 2. Properties of functional materials 3. Applications of functional materials Discussion and debate are necessary. Reference information such as scientific paper will be given, when necessary. Cited papers and citing papers in suggested papers should be read and understood.

### Textbook

Seminar documents are distributed.

### Additional Reading

A. R. West: Solid State Chemistry and its Applications (2nd Edition), Wiley, 2014 Reference information such as scientific paper will be given, when necessary.

### Grade Assessment

Presentation (50%), attitude (30%) and reports (20%). Low-dimensional functional material synthesis and their properties should be understood properly. Credits will be awarded to those students who understand nanomaterials. <Enrollees after 2020> A+: 100-95, A: 94-80, B: 79-70, C: 69-65, C-: 64-60, F: 59-0. <Enrollees before 2019> S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

Not applicable.

### Contacting Faculty

Professors will answer the questions after each seminar.

## Seminar on Solid State Chemistry 2E (2.0credits) (固体化学セミナー 2E)

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Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Materials Chemistry
Starts 1	3 Spring Semester
Lecturer	NAKANISHI Kazuki Professor

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### Course Purpose

Understanding of the studies on functional materials and training of how to establish creative researches.

### Prerequisite Subjects

Seminar on Solid State Chemistry 2A-2D

### Course Topics

Applications of nano-structured materials

### Textbook

Seminar documents are distributed. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition), Guozhong Cao and Ying Wang, World Scientific, 2010

### Additional Reading

### Grade Assessment

The evaluation of learning results will be performed by the presentations (50%) and the reports (50%). Credits will be awarded to those students who score 60 or more. Grades are as follows: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

### Notes

### Contacting Faculty

We have office hours after the seminar and accept questions about seminar contents.

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

### Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant's research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

#### Textbook

Will be introduced at the host laboratory depending on the research subject

#### Additional Reading

Will be introduced at the host laboratory if necessary

#### Grade Assessment

Conducting research in an abroad laboratory for one semester and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

#### Notes

Nothing particularly needed

#### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

### Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant's research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

#### Textbook

Will be introduced at the host laboratory depending on the research subject

#### Additional Reading

Will be introduced at the host laboratory if necessary

#### Grade Assessment

Conducting research in an abroad laboratory for two semesters and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

#### Notes

Nothing particularly needed

#### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

## Seminar on medical engineering (2.0credits) (医工連携セミナー)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Materials Process Engineering	Chemical Systems Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	
Starts 1	Spring Semester	Spring Semester	Spring Semester
	Spring Semester	Spring Semester	Spring Semester
	Spring Semester	Spring Semester	
Lecturer	Associated Faculty		

### Course Purpose

In the coming decades with growing overage population, novel technologies and outstanding ideas for the new breakthrough strategy of tailor-made medical therapy is strongly required. For the establishment of such strategy, basic technologies that enable the detection and diagnosis of molecular dynamics should be investigated. In this class, we try to educate young researchers to step out to this new frontier by setting various types of classes held by very advanced researchers in medical engineering field in Nagoya University. The lecturers are invited from engineering faculty and medical faculty, and introduce the expected ideas and the most recent achievements in the aspect of medical engineering.

### Prerequisite Subjects

Clinical medicine, Molecular biology, Biological engineering, Biomechanics, Robotics, Medical engineering, Bioinformatics

### Course Topics

In every lecture, different lectures invited from different fields (engineer, doctors, etc.) teach the most recent advances in the field of medical engineering. The lecture is mostly presented by power point, and for some classes, handouts are provided.

### Textbook

Not specified, but distributed handouts if necessary.

### Additional Reading

It will be appointed if necessary.

### Grade Assessment

Reports (80%) and interview (20%)

### Notes

Not needed

### Contacting Faculty

At lecture time



**Research Internship2 U2 (2.0credits) (研究インターンシップ2 U2)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

**Prerequisite Subjects**

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

**Course Topics**

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

**Textbook**

not specified.

**Additional Reading**

not specified.

**Grade Assessment**

The credits will be given to the students who have had the working days less than or equal to 20 days in the internship company.

Notes

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

**Research Internship2 U3 (3.0credits) (研究インターンシップ2 U3)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

**Prerequisite Subjects**

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

**Course Topics**

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

**Textbook**

not specified.

**Additional Reading**

not specified.

**Grade Assessment**

The credits will be given to the students who have had the working days between 21 and 40 days in the internship company.

Notes

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

## Research Internship2 U4 (4.0credits) (研究インターンシップ2 U4)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

### Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

### Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

### Textbook

not specified.

### Additional Reading

not specified.

### Grade Assessment

The credits will be given to the students who have had the working days between 41 and 60 days in the internship company.

Notes

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Research Internship2 U6 (6.0credits) (研究インターンシップ2 U6)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

### Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

### Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

### Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

### Textbook

not specified.

### Additional Reading

not specified.

### Grade Assessment

The credits will be given to the students who have had the working days between 61 and 80 days in the internship company.

Notes

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.



**Research Internship2 U8 (8.0credits) (研究インターンシップ2 U8)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

**Prerequisite Subjects**

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

**Course Topics**

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

**Textbook**

not specified.

**Additional Reading**

not specified.

**Grade Assessment**

The credits will be given to the students who have had the working days more than or equal to 81 days in the internship company.

Notes

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Laboratory Visit 1 U2 (2.0credits) (研究室ローテーション 2 U2)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

Up to 20 days research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Laboratory Visit 1 U3 (3.0credits) (研究室ローテーション 2 U3)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

### Course Purpose

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

### Prerequisite Subjects

Basic and specialized subjects related to the research subject

### Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

### Textbook

Will be introduced at the host laboratory depending on the research subject

### Additional Reading

Will be introduced at the host laboratory if necessary

### Grade Assessment

21 days or more and 40 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

### Notes

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

**Laboratory Visit 1 U4 (4.0credits) (研究室ローテーション 2 U4)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

**Course Purpose**

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

**Prerequisite Subjects**

Basic and specialized subjects related to the research subject

**Course Topics**

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

**Textbook**

Will be introduced at the host laboratory depending on the research subject

**Additional Reading**

Will be introduced at the host laboratory if necessary

**Grade Assessment**

41 days or more and 60 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

**Notes**

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.



**Laboratory Visit 1 U6 (6.0credits) (研究室ローテーション 2 U6)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

**Course Purpose**

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

**Prerequisite Subjects**

Basic and specialized subjects related to the research subject

**Course Topics**

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

**Textbook**

Will be introduced at the host laboratory depending on the research subject

**Additional Reading**

Will be introduced at the host laboratory if necessary

**Grade Assessment**

61 days or more and 80 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

**Notes**

Nothing particularly needed

### Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

**Laboratory Visit 1 U8 (8.0credits) (研究室ローテーション 2 U8)**

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

**Course Purpose**

The aim of this course is to expand the student's ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields. By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

**Prerequisite Subjects**

Basic and specialized subjects related to the research subject

**Course Topics**

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant's research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents. 1. Theme setting and literature review 2. Formulating the research plan 3. Analyzing the results and discussion 4. Presentation of the results After the class, students should review the analyzing process of the obtained results and investigate related literatures.

**Textbook**

Will be introduced at the host laboratory depending on the research subject

**Additional Reading**

Will be introduced at the host laboratory if necessary

**Grade Assessment**

81 days or more research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

**Notes**

Nothing particularly needed

**Contacting Faculty**

Questions will be answered by the supervisors at the host laboratory during the course.

Teaching and Instruction Exercise 1 (1.0credits) (実験指導体験実習1)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Hiroshi IKUTA Professor		

**Course Purpose**

While attendance is raw, in "the innovation experience project," I stand with a company engineer (DP, Directing Professor) and carry an assistance, DP of the attendance straight instruction by the DP and the role of the interface of the attendance student. In this way, it is intended to let you do experience of the project management.

I aim for planning a researcher, improvement of the nature as the leader, the expansion of the field of vision by a simulated experience of instruction of the attendance life and the business management in the real world.

**Prerequisite Subjects**

"Innovation Practice Course" 75 hours(Principle one day a week)

**Course Topics**

In "the innovation experience project," I assist the project promotion by the DP.

Help of the understanding of a project theme and contents for the attendance life of various specialisms

I compile an opinion of the attendance life and let you make a purpose, the method of the project clear

Exchange of opinions between the attendance life, instruction, report of the discussion

Communication adjustment that DP and attendance are raw

I assume this a main component.

In addition, correspondence out of the lecture time is necessary when preparations, an investigation to affect project accomplishment are necessary.

**Textbook**

## Teaching and Instruction Exercise 1 (1.0credits) (実験指導体験実習1)

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documents that a lecturer (DP) introduces it and shows.

### Additional Reading

documents that a lecturer (DP) introduces it and shows.

### Grade Assessment

I evaluate it through accomplishment, the discussion of the project. If display of leadership, report ability and the leadership is accepted, it is said that I pass.

### Notes

There are no prerequisites

### Contacting Faculty

A lecturer (DP) and this project staff of the university accept questions at any time.

Teaching and Instruction Exercise 2 (1.0credits) (実験指導体験実習2)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Syusaku NAGANO Associate Professor		

**Course Purpose**

The purpose of this course is to provide guidance to semester students for advanced science and engineering experiments at the Venture Business Laboratory. Through this research guidance, students will be able to play a comprehensive role as a researcher / educator and instructor in the field in charge of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation, and will be able to provide research guidance. Useful for practical training as a research leader.

**Prerequisite Subjects**

Knowledge of the field in charge selected from the fields of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation.

**Course Topics**

In the student experiment, the instructor students provide guidance to attendant students on subject research and original research from the field of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation with the professional teacher. Together with the attendant students, they perform practical use these equipment and software and get the results. They experience the leadership of the research, providing research guidance, report preparation guidance, and presentation guidance.

**Textbook**

Required documents is distributed.

**Additional Reading**

## Teaching and Instruction Exercise 2 (1.0credits) (実験指導体験実習2)

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Required documents is distributed.

### Grade Assessment

Evaluate by compiling experiments / exercises, teaching (70%), and interviewing (30%). Students who understand each device and software and give appropriate guidance are accepted, and their research results and new approaches are highly evaluated. A score of 60 or more out of 100 is a passing score.

### Notes

To have a deep understanding in one field from Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation.

### Contacting Faculty

Arranging the schedules by e-mail and etc.