Lecture on Chemical Systems Engineering (2.0credits) (化学工学システム論)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Chemical Systems Engineering
Starts 1	1 Spring Semester
Lecturer	Associated Faculty

●Course Purpose

The aim of this course is to deepen knowledge of material transformation in reaction and separation fields. Topics include fundamentals and recent advances in catalyst and its application for reaction-separation combined processes. The course also focuses on the separation of dispersed/fluid systems. Students learn physicochemical properties of dispersed phase as well as recent development in filtration and membrane separation techniques.

●Prerequisite Subjects

Mechanical Separation Engineering, Multiphase Flow, Fluid Flow with Exercises, Physical Chemistry, Chemical Reaction, Reaction Operation

●Course Topics

1. System of Reaction Engineering
2. Fundammentals of Reaction Engineering
3. New Trends of Catalytic Process
4. New Trends of Reaction under Separation Condition Process
5. System of Separation Engineering
6. System of Particle-Fluid Separation
7. Fundammentals and New Trends of Filtration
8. Fundammentals and New Trends of Membrane Separation
9. Classification of Surfactants
10. Formation of Micelles in Solution
11. Dynamics of Micelles Dispersion

●Textbook

Textbooks are not specified, but materials will be distributed as needed in class.

●Additional Reading

Specified as needed during the class

●Grade Assessment

Report and examination are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the fundamentals and recent advances in catalyst and its application for reaction-separation combined processes, the separation of dispersed/fluid systems, the physicochemical properties of dispersed phase, and the recent development in filtration and membrane separation techniques.

●Notes

●Contacting Faculty

During the class or at the office upon resevation.

Exercises of Advanced Physical Chemistry 1 (1.0credits) (先端物理化学演習1)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Exercise
Course Name	Chemical Systems Engineering
Starts 1	1 Spring Semester
Lecturer	Associated Faculty

●Course Purpose

The aim of this course is to develop students' skill in making oral presentation and discussion. The skill will be enhanced by making literature review of recent journal papers. Through the course, students will acquire practical abilities of presentation and discussion as well as a deep understanding of recent developments of materials science and engineering on physical and chemical aspects.

●Prerequisite Subjects

Each subject studied in Department of Materials Science and Engineering and also in Department of Chemical Engineering

●Course Topics

Literature survey, presentation and discussion on specific problems closely related to the research theme, including recent developments of materials science and engineering on physical and chemical aspects.

1. Chemical systems engineering
2. Materials chemistry

●Textbook

Specified as needed during the class

●Additional Reading

Specified as needed during the class

●Grade Assessment

Making oral presentation is essential. The presentation, discussion, and reports are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand a better way of making oral presentation and discussion as well as to understand and explain recent developments of materials science and engineering on physical and chemical aspects.

●Notes

●Contacting Faculty

E-mail: matsumiya.hiroaki@material.nagoya-u.ac.jp

Exercises of Advanced Physical Chemistry 2 (1.0credits) (先端物理化学演習2)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Exercise
Course Name	Chemical Systems Engineering
Starts 1	1 Autumn Semester
Lecturer	Associated Faculty

●Course Purpose

The aim of this course is to develop students' skill in making oral presentation and discussion. The skill will be enhanced by making literature review of recent journal papers. Through the course, students will acquire practical abilities of presentation and discussion as well as a deep understanding of recent developments of materials science and engineering on physical and chemical aspects.

●Prerequisite Subjects

Each subject studied in Department of Materials Science and Engineering and also in Department of Chemical Engineering

●Course Topics

Literature survey, presentation and discussion on specific problems closely related to the research theme, including recent developments of materials science and engineering on physical and chemical aspects.

1. Chemical systems engineering
2. Materials chemistry

●Textbook

Specified as needed during the class

●Additional Reading

Specified as needed during the class

●Grade Assessment

Making oral presentation is essential. The presentation, discussion, and reports are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand a better way of making oral presentation and discussion as well as to understand and explain recent developments of materials science and engineering on physical and chemical aspects.

●Notes

●Contacting Faculty

E-mail: matsumiya.hiroaki@material.nagoya-u.ac.jp

Seminars on Chemical Systems Engineering 1A (2.0credits) (化学システム工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose

The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects

Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics

To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook

The paper will be prepared by the presenter.

●Additional Reading

Indicated during class if necessary.

●Grade Assessment

Reports and Oral examinations

●Notes

No requirements.

●Contacting Faculty

Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 1A (2.0credits) (化学システム工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1A (2.0credits) (化学システム工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose

Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects

Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics

Deepen understanding by reading related literature and discussing research.

●Textbook

none.Appropriate handouts will be given.

●Additional Reading

Introduce as appropriate.

●Grade Assessment

Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes

No course requirements are required.

●Contacting Faculty

Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 1A (2.0credits) (化学システム工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1B (2.0credits) (化学システム工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose

The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects

Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics

To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook

The paper will be prepared by the presenter.

●Additional Reading

Indicated during class if necessary.

●Grade Assessment

Reports and Oral examinations

●Notes

No requirements.

●Contacting Faculty

Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 1B (2.0credits) (化学システム工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1B (2.0credits) (化学システム工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements are required.

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 1B (2.0credits) (化学システム工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1C (2.0credits) (化学システム工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose

The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects

Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics

To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook

The paper will be prepared by the presenter.

●Additional Reading

Indicated during class if necessary.

●Grade Assessment

Reports and Oral examinations

●Notes

No requirements.

●Contacting Faculty

Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 1C (2.0credits) (化学システム工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1C (2.0credits) (化学システム工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose

Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects

Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics

Deepen understanding by reading related literature and discussing research.

●Textbook

none.Appropriate handouts will be given.

●Additional Reading

Introduce as appropriate.

●Grade Assessment

Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes

No course requirements are required.

●Contacting Faculty

Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 1C (2.0credits) (化学システム工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1D (2.0credits) (化学システム工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose

The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects

Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics

To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook

The paper will be prepared by the presenter.

●Additional Reading

Indicated during class if necessary.

●Grade Assessment

Reports and Oral examinations

●Notes

No requirements.

●Contacting Faculty

Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 1D (2.0credits) (化学システム工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 1D (2.0credits) (化学システム工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements are required.

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 1D (2.0credits) (化学システム工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 1A (2.0credits) (材料化学セミナー1A)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	1 Spring Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, you will read the literature on thermoelectric materials and thermoelectric power generation systems, learn how to approach, proceed with, summarize, and research methods for research, investigate research trends in related fields, and deepen your understanding.
The goal is for students to achieve the following through this seminar.
1. Explain the principle of high-temperature reaction in the material manufacturing process.
2. Understand and explain various phenomena in thermoelectric materials.
3. Understand and explain various phenomena in thermoelectric generation systems.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering

●Course Topics

In this seminar, we will read the literature in the following fields.
1. Principle of thermoelectric conversion
2. Synthesis method of thermoelectric conversion material
3. Method of measuring thermoelectric properties
4. Optimization of thermoelectric module structure
5. Heat exchanger and thermoelectric generation system

Out-hours learning:
Prepare for the next class and understand the meaning of technical terms.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Goal achievement is evaluated by oral presentation (50%) and the corresponding question and answer (50%).
A pass is accepted if students can understand and explain principle of high-temperature reaction in material manufacturing process, various phenomena in thermoelectric materials, and various phenomena in thermoelectric power generation systems, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 1A (2.0credits) (材料化学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 1A (2.0credits) (材料化学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 1A (2.0credits) (材料化学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

Reports and presentation

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 1A (2.0credits) (材料化学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science exploiting informatics. Performance targets: To get abilities as follows: (i) To have comprehensive views on materials informatics and machine learning including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) (i) The latest trends on the materials science and technologies related toorganic solar cells for energy conversions. (ii) The cutting edge research in the materials science and technologies related toorganic semiconducting materials for organic solar cells. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(2) (i) The latest trends on the materials science and technologies related toelectrochemical devices for energy conversions. (ii) The cutting edge research in the materials science and technologies related toelectrochemical devices for energy conversions. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(3) (i) The latest trends on the use of informatics in materials development. (ii) The cutting-edge research in materials informatics and machine learning. (iii) The extraction of research topics and generation of new ideas. (iv) The proposal for a new research theme.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 1B (2.0credits) (材料化学セミナー1B)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	1 Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, recent research and issues on thermoelectric materials and thermoelectric power generation systems will be taken up, and by conducting reading exercises, the latest research trends will be grasped, as well as approaches to research, how to proceed, summaries, research methods, etc. And clarify the position of the master's thesis.
The goal is for students to achieve the following through this seminar.
1. Explain the principles of thermoelectric materials and thermoelectric power generation systems related to the themes of the master's thesis.
2. Understand the basics of thermoelectric materials and thermoelectric power generation systems, and apply them to their basic designs.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering

●Course Topics

In this seminar, we will read the literature in the following fields.
1. Principle of thermoelectric conversion
2. Synthesis method of thermoelectric material
3. Method of measuring thermoelectric properties
4. Optimization of thermoelectric module structure
5. Heat exchanger and thermoelectric generation system

Out-hours learning:
Prepare for the next class and understand the meaning of technical terms.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Goal achievement is evaluated by oral presentation (50%) and the corresponding question and answer (50%).
A pass is accepted if students can explain the principles of thermoelectric conversion materials and thermoelectric power generation systems related to the themes of the master's thesis, understand the basics of thermoelectric conversion materials and thermoelectric power generation systems, and apply them to their basic design, and the results will be reflected accordingly, if students can deal with more difficult matters. Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 1B (2.0credits) (材料化学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 1B (2.0credits) (材料化学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Nagahiro Saito Professor	Junko HIEDA Associate Professor	Tomonaga UENO Assistant Professor

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 1B (2.0credits) (材料化学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 1B (2.0credits) (材料化学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) For some topics related to material research using informatics, we will clarify and embody the methods to tackle the issues. The purpose of the course is to acquire practical skills to apply techniques specific to each topic. Performance targets: To get abilities as follows: (i) To choose one of the remaining challenges and find methods to approach it. (ii) To learn techniques unique to each topic. (iii) To summarize the research briefly.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) (i) The latest trends on the materials science and technologies related toorganic solar cells for energy conversions. (ii) The cutting edge research in the materials science and technologies related toorganic semiconducting materials for organic solar cells. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(2) (i) The latest trends on the materials science and technologies related toelectrochemical devices for energy conversions. (ii) The cutting edge research in the materials science and technologies related toelectrochemical devices for energy conversions. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(3) (i) The methods to solve challenges on the use of informatics in materials development. (ii) The application of methods in materials informatics and machine learning. (iii) The theoretical development of the method and its validation. (iv) The presentation of research results.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 1C (2.0credits) (材料化学セミナー1C)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	2 Spring Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, recent research and issues related to thermoelectric materials and thermoelectric power generation systems will be taken up from the viewpoint of process engineering. Discuss.
The goal is for students to achieve the following through this seminar.
1. Explain the principles and actual applications of various thermoelectric material manufacturing processes.
2. Understand the basics of thermoelectric materials and thermoelectric power generation systems, and apply them to their basic design and analysis.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering

●Course Topics

In this seminar, we will read the literature in the following fields.
1. Principle of thermoelectric conversion
2. Synthesis method of thermoelectric material
3. Method of measuring thermoelectric properties
4. Optimization of thermoelectric module structure
5. Heat exchanger and thermoelectric generation system

Out-hours learning:
Prepare for the next class and understand the meaning of technical terms.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Goal achievement is evaluated by oral presentation (50%) and the corresponding question and answer (50%).
A pass is accepted if students can explain principle and actual application of manufacturing process of various thermoelectric materials, understand basics of thermoelectric materials and thermoelectric power generation systems, and apply them to their basic design and analysis. The results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 1C (2.0credits) (材料化学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 1C (2.0credits) (材料化学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Nagahiro Saito Professor	Junko HIEDA Associate Professor	Tomonaga UENO Assistant Professor

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 1C (2.0credits) (材料化学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 1C (2.0credits) (材料化学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) We will clarify the problems on materials informatics specifically in the process of developing the newly proposed method to solve the remaining challenges. The purpose of the course is to deepen understandings on the issues. Performance targets: To get abilities as follows: (i) To have an image of research results based on research experience. (ii) To perform multiple approaches to solve the problem.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Summary of research progress before each class is required.(1) (i) The latest trends on the materials science and technologies related toorganic solar cells for energy conversions. (ii) The cutting edge research in the materials science and technologies related toorganic semiconducting materials for organic solar cells. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(2) (i) The latest trends on the materials science and technologies related toelectrochemical devices for energy conversions. (ii) The cutting edge research in the materials science and technologies related to electrochemical devices for energy conversions. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(3) (i) The promotion of research in materials informatics and machine learning. (ii) The development of the theory and the validation of the proposed method. (iii) The appealing presentation of research.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 1D (2.0credits) (材料化学セミナー1D)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	2 Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, recent research and issues on thermoelectric materials and thermoelectric power generation systems will be taken up, and a reading exercise will be conducted to grasp the latest research trends and clarify the position of the master's thesis. In addition, based on the plan and results of experimental research along the themes of the master's thesis, discussions will be held toward the completion of the thesis.
The goal is for students to achieve the following through this seminar.
1. Explain the principles and actual applications of various thermoelectric material manufacturing processes.
2. Understand the basics of thermoelectric materials and thermoelectric power generation systems, and apply them to their basic design and analysis.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering

●Course Topics

In this seminar, we will read the literature in the following fields.
1. Principle of thermoelectric conversion
2. Synthesis method of thermoelectric material
3. Method of measuring thermoelectric properties
4. Optimization of thermoelectric module structure
5. Heat exchanger and thermoelectric generation system

Out-hours learning:
Prepare for the next class and understand the meaning of technical terms.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Goal achievement is evaluated by oral presentation (50%) and the corresponding question and answer (50%).
A pass is accepted if students can explain principle and actual application of manufacturing process of various thermoelectric materials, understand basics of thermoelectric materials and thermoelectric power generation systems, and apply them to their basic design and analysis. The results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 1D (2.0credits) (材料化学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 1D (2.0credits) (材料化学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Nagahiro Saito Professor	Junko HIEDA Associate Professor	Tomonaga UENO Assistant Professor

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 1D (2.0credits) (材料化学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 1D (2.0credits) (材料化学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) The purpose of the course is to derive the solution for a research topic on materials informatics by using a method selected by the attendees, and to summarize the results. Performance targets: To get abilities as follows: (i) To derive a comprehensive solution for the research topic. (ii) To summarize the research results in a convincing manner.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Summary of research progress before each class is required.(1) (i) The latest trends on the materials science and technologies related toorganic solar cells for energy conversions. (ii) The cutting edge research in the materials science and technologies related toorganic semiconducting materials for organic solar cells. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(2) (i) The latest trends on the materials science and technologies related toelectrochemical devices for energy conversions. (ii) The cutting edge research in the materials science and technologies related to electrochemical devices for energy conversions. (iii) The extraction of research issues and generation of new ideas. (iv) The proposal for a new research theme.(3) (i) The promotion of research on materials informatics and machine learning. (ii) The presentation and publication of research results.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

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	
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	
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.

Separation and Fusion Engineering (2.0credits) (分離融合工学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Autumn Semester ,every other year	
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor

●Course Purpose

The developments of basic and new technologies in separation and fusion engineering and their applications to various fields are lectured. Achievement target: Understand the basics of separation and fusion engineering and recent research trends and apply them.

●Prerequisite Subjects

Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics

1. Filtration and membrane filtration technology, 2. Dynamic filtration technology, 3. Sedimentation and flocculation technology, 4. Centrifugation technology, 5. Equipment for mechanical separation, 6. Bioprocess and biotechnology, 7. Microbial culture engineering, 8. Animal cell culture engineering. Students are required to submit some reports.

●Textbook

Advance of Chemical Engineering 39 "Frontier Particle-Fluid Separation Technology", Makishoten, 2005 (Handouts will be prepared). Takeshi Kobayashi "Bioprocess no miryoku", Baifukan, 1996.

●Additional Reading

"Kagaku Kogaku Binran - Fifth Edition -", Maruzen, 1999. "Handbook of filtration engineering", Maruzen, 2009. "Hiraku Hiraku Bio no sekai", Kagakudojin, 2012.

●Grade Assessment

Examination and Reports

●Notes

No requirements.

●Contacting Faculty

Accepted anytime, also via email.

Advanced Chemical Reaction Engineering (2.0credits) (先進反応工学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Spring Semester ,every other year	
Lecturer	Noriyuki KOBAYASHI Associate Professor	Seiichi DEGUCHI Lecturer

●Course Purpose

•Course Purpose
In order to understand the Principles of advanced chemical reaction engineering, the transports of chemical species, heats and mass are acquired as analogous formulae. The various materials productions and manufacturing processes are expected to be learned.

Students are expected to obtain the following abilities concerning advanced chemical reaction engineering;
(1) To create future advanced chemical reactions with sustainability
(2) To design chemical reactors
(3) To understand equilibrium calculations

●Prerequisite Subjects

●Course Topics

1. Process developments realted to chamincal reaction engineering
2. Process developments realted to catalytic engineering
3. Hydorgen procucing processes
4. Green chemical reaction processes
5. Evaluation systems and methods for catalyst efficiencies
6. Molecular theory of catalytic engineering
7. Separation with using chamical reactions
8. Fuel cells
10. Examples of chemical reaction devices
11. Desibn and analyses of reaction devices

In addition, students must prepare the next lecture with prints to be distributed beforehand in advance, and make reports.
Reports will be collected during lectures.

●Textbook

Appropriate handouts will be given before the class.
Specific citations will be given in the class.

●Additional Reading

●Grade Assessment

●Notes

No course requirements are required.
This course will be taught in Japanese.

●Contacting Faculty

Energy Conversion Engineering (2.0credits) (エネルギー変換工学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Spring Semester ,every other year	
Lecturer	Hideki KITA Professor	"Takashi ITOH" Associate Professor

●Course Purpose

Exergy, also referred to as active energy, is a common indicator for substances and energy that indicate energy quality. Although various systems are being developed, it is important to take into account not only enthalpy but also exergy and use both in order to steadily promote effective use of energy. Students also understand thermoelectric materials and their systems that can directly convert thermal energy and electrical energy to each other.

Students are expected to achieve the following contents through this lecture.

1. Understand the meaning of exergy and apply to specific problems.
2. Perform basic calculations of heat, chemistry, and pressure exergy yourself.
3. An exergy analysis can be performed on a manufacturing system or a device including a plurality of subsystems, and a method for improving efficiency can be described.
4. Explain the basic principle of thermoelectric conversion.
5. Explain thermoelectric conversion materials, modularization technology and system design.

●Prerequisite Subjects

Physical chemistry, Thermodynamics, Solid state physics, Heat transfer and diffusion

●Course Topics

1. Confirmation of basic matters of thermodynamics, entropy, amount and quality of energy
2. Pressure, heat exergy

3Chemistry, mixing, dynamics, radiation exergy

4Exergy analysisas a tool for process designapplications

5. Principles of thermoelectric cooling and thermoelectric generation
6. Thermoelectric properties and figure of merit
7. Thermoelectric materials and processing technology, segmented thermoelectric elements
8. Modularization technology, system design

After the lecture, read back the distributed materials and documents to deepen your understanding. A short test 15 min) is conducted to evaluate the level of understanding of the previous lecture, and submitted during the lecture. In addition, students are required to submit several report assignments after solving them.

●Textbook

None. Distribute materials as necessary

●Additional Reading

Ekuserugi no kiso :kenichi karakida (ohmusya)

Netsudenhenkan -kiso to ouyou-: Ryo Sakata ed. (Syokabo)

●Grade Assessment

The degree of achievement for the achievement target is evaluated by reports and written tests.

“Pass” is given to the student who is able to correctly understand the basic issues with respect to the items shown in the class contents. For the student who is able to understand more difficult questions, reflect them on the grade according to the level and results of the questions.

●Notes

Understand thermodynamics taken in undergraduate school

●Contacting Faculty

Lecturers will respond during breaks and office hours after lectures.
Professor Hideki Kita: Extension 3096,
email: kita.hideki@material.nagoya-u.ac.jp
Associate Professor Takashi Itoh: Extension 6064,
email: itoh.takashi@material.nagoya-u.ac.jp

Environmental Systems Engineering (2.0credits) (循環システム工学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Autumn Semester ,every other year	
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor

●Course Purpose
Lectures on elemental technologies, current status and future prospects on resource, environment and energy issues are made to raise student awareness of these issues.

●Prerequisite Subjects
Chemical engineering, material engineering, physical chemistry

●Course Topics
1. Resource, environment and energy issues and policies, 2. Air pollution and prevention technologies, 3. Water pollution and prevention technologies, 4. Soil pollution and prevention technologies, 5. New energy technologies (especially biomass)

●Textbook
Printed materials will be prepared and distributed in class. Some of the lecture notes will be posted on Nagoya University Collaboration and Course Tools (NUCT).

●Additional Reading
Additional references will be introduced in class.

●Grade Assessment
Several report assignments will be given, where students search for recent literature to gain further understanding and knowledge of the topics discussed in class. Feedback will be given to improve students' writing skills. A minimum score of 60 or higher out of 100 should be obtained to pass this course.Grades: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

●Notes
No additional requirement

●Contacting Faculty
Students can reach instructors through the NUCT tools, or by email. Office hourswill be held at the end of the course to support students to write their reports.

Interface Chemistry (2.0credits) (界面化学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Spring Semester ,every other year	
Lecturer	Nagahiro Saito Professor	Junko HIEDA Associate Professor

●Course Purpose

The surface and interface properties of the material are different from the internal properties. In particular, it is important to know the properties of interfaces in fields of nanotechnology.
Lectures will be given on macro-level approaches such as free energy and micro-level approaches at the atomic level.
Students will also learn about surface and interface phenomena of actual industrial materials, their control technology, and their application to manufacturing processes.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Catalytic Chemistry (2.0credits) (触媒化学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Spring Semester ,every other year	
Lecturer	KATSUTOSHI Nagaoka Professor	YutakaMATSUO Professor

●Course Purpose

The purpose of this course is understanding of basic principles and concepts in catalysis playing important roles in chemical industry through learning structures, elementary reaction steps, kinetics, and characterization methods in various kinds of catalysis.
Students can achieve the following things by learning this course.
1. Understanding representative catalytic processes and being able to explain the processes.
2. Understanding reaction mechanisms of the catalysis and being able to explain the kinetics.
3. Understanding characterization methods to clarify characteristics of the catalysts and being able to suggest characterization appropriately.
4. Understanding structures of catalysts that contribute to catalytic reaction and being able to explain importance of catalysts' structures.
5. Understanding that catalytic reactions are useful for energy conversion as well as materials conversion and being able to explain this.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Separation Chemistry (2.0credits) (分離化学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Autumn Semester ,every other year	
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor

●Course Purpose

This course deals with the principles and applications of separation chemistry for instrumental analysis and purification processes. Through the course, students will develop an understanding of the fundamentals and applications of various chemical separation techniques.

●Prerequisite Subjects

●Course Topics

●Textbook

Textbooks are not specified, but materials will be distributed as needed in class.

●Additional Reading

Specified as needed during the class

●Grade Assessment

●Notes

●Contacting Faculty

During the class, the teacher's office during work hour or e-mail

H. Matsumiyamatsumiya.hiroaki@material.nagoya-u.ac.jp
R. Ichinoichino.ryoichi@material.nagoya-u.ac.jp

Non-equilibrium Thermodynamics (2.0credits) (非平衡熱力学)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Chemical Systems Engineering	
Starts 1	Autumn Semester ,every other year	
Lecturer	Wataru NORIMATSU Associate Professor	Yoshihiro KOJIMA Associate Professor

●Course Purpose

In this lecture, on the basis of the thermodynamics of equilibrium system and quasistatic process, students learn the basics of nonequilibrium thermodynamics.

The students are expected to obtain the following fundamental and practical abilities.
(1) To understand the principles of nonequilibrium thermodynamics
(2) To analyze problems concerning nonequilibrium phenomena which appear in various scenes of materials science/engineering and chemical engineering processes.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Phase Equilibrium, Electrochemistry, Material Process Engineering

●Course Topics

1. The first and second laws of thermodynamics, Gibbs equation, Entropy change in irreversible processes
2. The flows and forces acting in irreversible processes, Entropy production, The phenomenological equations for flows and forces
3. Diffusion, Chemical reactions
4. Statistical mechanics for nonequilibrium states, The principle of minimum entropy production

●Textbook

Appropriate textbooks Will be introduced in the class or/and appropriate handouts will be given.

●Additional Reading

Will be introduced in the class as appropriate.

●Grade Assessment

Examinations (70%)) and papers(30%): More than 60 scores on the basis of 100 are acceptable.

●Notes

This course will be taught in Japanese.

●Contacting Faculty

In case of questions: Make contact to

Assoc.Prof. Norimatsu: norimatsu.wataru@material.nagoya-u.ac.jp
Assoc.Prof. Kojima: ykojima@imass.nagoya-u.ac.jp

Advanced Experiments and Exercises on Chemical Systems 1 (2.0credits) (化学システム工学特別実験及び演習1

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
Students will deepen their understanding through experiments and exercises on separation and fusion system engineering. Achievement target: 1. Learn experimental techniques and evaluation methods related to separation and fusion system engineering and apply them. 2. Deepen understanding and apply them through experiments and exercises on separation and fusion system engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
The lesson consists of the following three contents. 1. Setting of research theme and literature search, 2. Design and implementation of research plan, 3. Analysis of data and interpretation of results, 4. Presentation of research results. Meeting with your supervisor at any time.

●Textbook
Indicated if necessary.

●Additional Reading
Indicated if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Advanced Experiments and Exercises on Chemical Systems 1 (2.0credits) (化学システム工学特別実験及び演習1

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to search the drawback for the concrete study theme through catalytic chemistry, reaction engineering, the experiment about the thermochemical study field and carry out experiments. Students will acquire the
following knowledge, and ability in the end of the class.

1.Searching a problem regarding study theme.
2.Suggesting the solution for the problem and being settled by experiments.
3.Describing a background, a problem, the solution to study theme in sentences and making presentation and discussing it.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Chemical Systems 1 (2.0credits) (化学システム工学特別実験及び演習1

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
To acquire the research method through basic experiments and exercises related to thermal energy system engineering.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
1. Heat flow measurement method
2. Heat flow analysis method
3. Energy system design method
4. Separation / detoxification / purification technology design method
5. Simultaneous heat and mass transfer analysis method
And related technologies

●Textbook
none.
Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements are required.

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Advanced Experiments and Exercises on Chemical Systems 1 (2.0credits) (化学システム工学特別実験及び演習1

Course Type	Specialized Courses				
Division at course	Master's Course				
Class Format	Experiment and Exercise				
Course Name	Chemical Systems Engineering				
Starts 1	1 Spring and Autumn Semester				
Lecturer	Koyo NORINAGA	Professor	KeijiYASUDA	Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Chemical Systems 2 (2.0credits) (化学システム工学特別実験及び演習2

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
Students will deepen their understanding through experiments and exercises on separation and fusion system engineering. Achievement target: 1. Learn experimental techniques and evaluation methods related to separation and fusion system engineering and apply them. 2. Deepen understanding and apply them through experiments and exercises on separation and fusion system engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
The lesson consists of the following three contents. 1. Setting of research theme and literature search, 2. Design and implementation of research plan, 3. Analysis of data and interpretation of results, 4. Presentation of research results. Meeting with your supervisor at any time.

●Textbook
Indicated if necessary.

●Additional Reading
Indicated if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Advanced Experiments and Exercises on Chemical Systems 2 (2.0credits) (化学システム工学特別実験及び演習2

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to search the drawback for the concrete study theme through catalytic chemistry, reaction engineering, the experiment about the thermochemical study field and carry out experiments. Students will acquire the
following knowledge, and ability in the end of the class.

1.Searching a problem regarding study theme.
2.Suggesting the solution for the problem and being settled by experiments.
3.Describing a background, a problem, the solution to study theme in sentences and making presentation and discussing it.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Chemical Systems 2 (2.0credits) (化学システム工学特別実験及び演習2

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
To acquire the research method through basic experiments and exercises related to thermal energy system engineering.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
1. Heat flow measurement method2. Heat flow analysis method3. Energy system design method4. Separation / detoxification / purification technology design method5. Simultaneous heat and mass transfer analysis methodAnd related technologies

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Advanced Experiments and Exercises on Chemical Systems 2 (2.0credits) (化学システム工学特別実験及び演習2

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Materials Chemistry 1 (2.0credits) (材料化学特別実験及び演習1)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Chemical Systems Engineering
Starts 1	1 Spring and Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In the Experiment and Exercise in Materials Chemistry 1, students are required to make laboratory experimental works and exercises concerning the materials analysis and materials sciences for environments, accepting advices and instructions from the teaching staffs of the laboratories. Thorough the experiments and exercises, students are expected to advance their knowledge of the basic sciences in the fields of materials research. The students are also expected to deepen their understandings of their own research subjects.
The goal of students is to achieve the following contents through this experiment and exercise.
1. Set research themes and formulate experimental plans.
2. Exercises on theory and experimental methods.
3. Perform experiments and accurately analyze experimental results.
4. Fully consider the experimental results
5. Modify the experimental design based on experimental results and considerations.

●Prerequisite Subjects

Major subjects of the Departments of System Chemistry Engineering, Materials Process Engineering, and, Materials Design Engineering

●Course Topics

1. Setting the theme and planning experiments concerning the theme
2. Exercises of the theoretical background and the experimental techniques
3. Making experiments according to the initial plan
4. Analysis of the experimental results and discussions

Out-hours learning:
Prepare and fully understand the contents of the experiments and exercises to be performed next time.

●Textbook

Textbooks are not used. Prints will be distributed as needed.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Acquisition of experiments and exercises is evaluated by planning reports, analysis reports, and oral presentations.
A pass is accepted, if students can handle correctly basic problem for the items listed in the lesson contents, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Advanced Experiments and Exercises on Materials Chemistry 1 (2.0credits) (材料化学特別実験及び演習1)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

Students are required to make laboratory experimental works and exercises concerning the materials chemistry, accepting advices and instructions from the teaching staffs of the laboratories. Thorough the experiments and exercises, students are expected to advance their knowledge of the basic sciences in the fields of materials research. The students are also expected to deepen their understandings of their own research subjects.

●Prerequisite Subjects

Major subjects of the Department of Materials Science and Engineering

●Course Topics

1. Setting the theme and planning experiments concerning the theme
2. Exercises of the theoretical background and the experimental techniques
3. Making experiments according to the initial plan
4. Analysis of the experimental results and discussions (replanning experiments, if necessary)

●Textbook

Specified as needed during the class

●Additional Reading

Specified as needed during the class

●Grade Assessment

The attainment of experiments and exercises as well as discussion are evaluated for the grade judgement (based on written reports and oral presentation). To pass, students must earn at least 60 points out of 100. It is required to understand the basic sciences of their own research subjects and to utilize the knowledge in the fields of materials research.

●Notes

●Contacting Faculty

During the class or at the office upon resevation.

Advanced Experiments and Exercises on Materials Chemistry 1 (2.0credits) (材料化学特別実験及び演習1)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students address the developement of novel chemical processes and materials from the viewpoint of materials engineering. Through these activities, students will develop the ability to think about approaches to solving problems, conduct experiments systematically, and acquire specialized and advanced experimental operations and analytical methods.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Materials Chemistry 1 (2.0credits) (材料化学特別実験及び演習1)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this experiment/exercise class, students perform experiments and exercise under supervision of the lecturer, in order to deeply understand the basics on the low-dimensional materials and to develop abilities for the engineering research on the new materials development.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

face-to-face, e-mail

Advanced Experiments and Exercises on Materials Chemistry 1 (2.0credits) (材料化学特別実験及び演習1)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring and Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia in the process of tackling a specific research topic related to organic semiconductors and organic solar cells. Performance targets: To get abilities as follows: (i) To explain the significance of research theme from social and academic perspectives. (ii) To propose research plan according to the research purpose for conducting research and collecting necessary data. (iii) To analyze data appropriately and to discover the underlying mechanisms and new knowledge. (iv) To summarize research results logically and communicate academically.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia in the process of tackling a specific research topic related to electrochemistry and energy conversion. Performance targets: To get abilities as follows: (i) To explain the significance of research theme from social and academic perspectives. (ii) To propose research plan according to the research purpose for conducting research and collecting necessary data. (iii) To analyze data appropriately and to discover the underlying mechanisms and new knowledge. (iv) To summarize research results logically and communicate academically. (3) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia in the process of tackling a specific research topic related to materials science exploiting informatics. Performance targets: To get abilities as follows: (i) To explain the significance of research theme from social and academic perspectives. (ii) To propose research plan according to the research purpose for conducting research and writing necessary programing. (iii) To analyze data appropriately and to discover the underlying mechanisms and new knowledge. (iv) To summarize research results logically and communicate academically.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) (i) The comprehensive views on the prior works in organic semiconductors and organic solar cells. (ii) The planning and promotion of the research. (iii) The data analysis, extraction of underlying mechanisms and proposal of new methods. (iv) The presentation of research results.(2) (i) The comprehensive views on the prior works in fuel cells and water spliting. (ii) The planning and promotion of the research. (iii) The data analysis, extraction of underlying mechanisms and proposal of new methods. (iv) The presentation of research results.(3) (i) The comprehensive views on the prior works in materials informatics and machine learning. (ii) The planning and promotion of the research. (iii) The data analysis, extraction of underlying mechanisms and proposal of new methods. (iv) The presentation of research results.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of research promotion (50%), presentations (30%) and discussions (20%). Academic and engineering significance of the research (1 or more accepted papers and 1 or more presentations in international conferences) will be accounted.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building.(3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Advanced Experiments and Exercises on Materials Chemistry 2 (2.0credits) (材料化学特別実験及び演習2)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Exercise
Course Name	Chemical Systems Engineering
Starts 1	2 Spring and Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In the Experiment and Exercise in Materials Chemistry 2, students are required to make laboratory experimental works and exercises concerning the materials analysis and materials sciences for environments, accepting advices and instructions from the teaching staffs of the laboratories. Thorough the experiments and exercises, students are expected to advance their knowledge of the basic sciences in the fields of materials research. The students are also expected to deepen their understandings of their own research subjects.
The goal of students is to achieve the following contents through this experiment and exercise.
1. Set research themes and formulate experimental plans.
2. Exercises on theory and experimental methods.
3. Perform experiments and accurately analyze experimental results.
4. Fully consider the experimental results
5. Modify the experimental design based on experimental results and considerations.

●Prerequisite Subjects

Major subjects of the Departments of System Chemistry Engineering, Materials Process Engineering, and, Materials Design Engineering

●Course Topics

1. Setting the theme and planning experiments concerning the theme
2. Exercises of the theoretical background and the experimental techniques
3. Making experiments according to the initial plan
4. Analysis of the experimental results and discussions

Out-hours learning:
Prepare and fully understand the contents of the experiments and exercises to be performed next time.

●Textbook

Textbooks are not used. Prints will be distributed as needed.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Acquisition of experiments and exercises is evaluated by planning reports, analysis reports, and oral presentations.
A pass is accepted, if students can handle correctly basic problem for the items listed in the lesson contents, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Advanced Experiments and Exercises on Materials Chemistry 2 (2.0credits) (材料化学特別実験及び演習2)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

Students are required to make laboratory experimental works and exercises concerning the materials chemistry, accepting advices and instructions from the teaching staffs of the laboratories. Thorough the experiments and exercises, students are expected to advance their knowledge of the basic sciences in the fields of materials research. The students are also expected to deepen their understandings of their own research subjects.

●Prerequisite Subjects

Major subjects of the Department of Materials Science and Engineering

●Course Topics

1. Setting the theme and planning experiments concerning the theme
2. Exercises of the theoretical background and the experimental techniques
3. Making experiments according to the initial plan
4. Analysis of the experimental results and discussions (replanning experiments, if necessary)

●Textbook

Specified as needed during the class

●Additional Reading

Specified as needed during the class

●Grade Assessment

The attainment of experiments and exercises as well as discussion are evaluated for the grade judgement (based on written reports and oral presentation). To pass, students must earn at least 60 points out of 100. It is required to understand the basic sciences of their own research subjects and to utilize the knowledge in the fields of materials research.

●Notes

●Contacting Faculty

During the class or at the office upon resevation.

Advanced Experiments and Exercises on Materials Chemistry 2 (2.0credits) (材料化学特別実験及び演習2)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students address the developement of novel chemical processes and materials from the viewpoint of materials engineering. Through these activities, students will develop the ability to think about approaches to solving problems, conduct experiments systematically, and acquire specialized and advanced experimental operations and analytical methods.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Advanced Experiments and Exercises on Materials Chemistry 2 (2.0credits) (材料化学特別実験及び演習2)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this experiment/exercise class, students perform experiments and exercise under supervision of the lecturer, in order to deeply understand the basics on the low-dimensional materials and to develop abilities for the engineering research on the new materials development.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

face-to-face, e-mail

Advanced Experiments and Exercises on Materials Chemistry 2 (2.0credits) (材料化学特別実験及び演習2)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring and Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to create original research with systematizing results through conducting academic and social valuable original research projects in organic semiconductors and organic solar cells for acquiring the ability to present information with impact.Performance targets: (i) To promote research plan to derive significant results. (ii) To discover new knowledge and propose new methods from data analysis and theoretical considerations. (iii) To summarize research results logically and present papers and oral presentations.(2) The purpose of the course is to create original research with systematizing results through conducting academic and social valuable original research projects in electrochemistry-based energy conversion for acquiring the ability to present information with impact.Performance targets: (i) To promote research plan to derive significant results. (ii) To discover new knowledge and propose new methods from data analysis and theoretical considerations. (iii) To summarize research results logically and present papers and oral presentations.(3) The purpose of the course is to tackle a concrete research topic related to materials science using informatics and to summarize research results valuable both in society and academia in an appealing manner. Performance targets: (i) To promote research plan to derive significant results. (ii) To discover new knowledge and propose new methods from data analysis and theoretical considerations. (iii) To summarize research results logically and present papers and oral presentations.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Summary of research progress before each class is required.(1) (i) The investigation of organic semiconductors and organic solar cells. (ii) The promotion of the research. (iii) The data analysis, extraction of underlying mechanisms, and proposal of new methods. (iv) The presentation of research results including papers and oral presentations.(2) (i) The investigation of fuel cells and water spliting. (ii) The promotion of the research. (iii) The data analysis, extraction of underlying mechanisms, and proposal of new methods. (iv) The presentation of research results including papers and oral presentations. (3) (i) The investigation of unique machine learning techniques to solve the problem. (ii) The promotion of the research. (iii) The data analysis, extraction of underlying mechanisms, and proposal of new methods. (iv) The presentation of research results including papers and oral presentations.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of research promotion (50%), presentations (30%) and discussions (20%). Academic and engineering significance of the research (2 or more accepted papers and 1 or more presentations in international conferences) will be accounted.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

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	
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 Internship１ 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	
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 studnt 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 Internship１ 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	
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 studnt 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 Internship１ 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	
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 studnt 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 Internship１ 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	
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 studnt 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 Internship１ 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	
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 daysin the internship company.

●Notes

The studnt 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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.

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

Advanced Lectures on Frontier Technologies and Sciences (1.0credits) (最先端理工学特論)

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 and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 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.

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	
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 hesitance
-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		
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 hibrid cars, electric cars, automated driving and crash safety. It is asle intended to develop the English hearing/speaking ability. The attainment targets are as follows:

1. Understand the latest technology of automotive engineering.
2. Underatand company's automotive production system.
3. Improve English ability in the field of socience 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 repor 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 undastanding 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	
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 I)

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II)

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	
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)

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Chemical Systems Engineering
Starts 1	1 Spring and Autumn Semester
Lecturer	Associated Faculty

●Course Purpose
Students will be dispatched to research and development departments of university-outside research organization such as cooperating companies etc. and engaged in research and development work on prescribed themes for a predetermined period to learn how to set up and solve technical problems at companies and other sites. With this experience, students acquire practical and broad insight, comprehensive ability, imagination and adaptability to the real world.

●Prerequisite Subjects
Each subject studied in Department of Materials Science and Engineering and also in Department of Chemical Engineering

●Course Topics
Students' research contents are negotiated by agreement with the companies etc.

●Textbook
Textbooks are not specified, but materials will be distributed as needed for training.

●Additional Reading
Specified as needed during the training

●Grade Assessment
The achievement is evaluation by the corporate leaders, oral presentations of research results, and reports. To pass, students must earn at least 60 points out of 100. It is required to understand how to set up and solve technical problems in the real world.

●Notes

●Contacting Faculty
Academic advisors and persons in charge of hosting companies etc.

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 Intelectual 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 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.13:0014:00 @Green Vehicle Material Research Building 1F
Mail to: o_shimizu@nuem.nagoya-u.ac.jp

ced Mobility Program Practical Training Course(Autonomous Vehicle) (2.0credits) (先進モビリティ学実習（自動運

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.

ced Mobility Program Practical Training Course(Autonomous Vehicle) (2.0credits) (先進モビリティ学実習（自動運

●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.13:0014:00 @Green Vehicle Material Research Building 1F
Mail to: o_shimizu@nuem.nagoya-u.ac.jp

dvanced Mobility Program Practical Training Course(Electric Vehicle) (2.0credits) (先進モビリティ学実習（ＥＶ）

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.13:0014:00 @Green Vehicle Material Research Building 1FMail to: o_shimizu@nuem.nagoya-u.ac.jp

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	
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 well 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.

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	
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 well 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.

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	
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 well 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 literature2. Designing research plan3. Analysis and discussion of results4. Brief summary and future prospectsHomework 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 discussionGrading 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.

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

Seminars on Chemical Systems Engineering 2A (2.0credits) (化学システム工学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook
The paper will be prepared by the presenter.

●Additional Reading
Indicated during class if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 2A (2.0credits) (化学システム工学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2A (2.0credits) (化学システム工学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 2A (2.0credits) (化学システム工学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2B (2.0credits) (化学システム工学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook
The paper will be prepared by the presenter.

●Additional Reading
Indicated during class if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 2B (2.0credits) (化学システム工学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2B (2.0credits) (化学システム工学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 2B (2.0credits) (化学システム工学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2C (2.0credits) (化学システム工学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook
The paper will be prepared by the presenter.

●Additional Reading
Indicated during class if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 2C (2.0credits) (化学システム工学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2C (2.0credits) (化学システム工学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 2C (2.0credits) (化学システム工学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2D (2.0credits) (化学システム工学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook
The paper will be prepared by the presenter.

●Additional Reading
Indicated during class if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 2D (2.0credits) (化学システム工学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2D (2.0credits) (化学システム工学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 2D (2.0credits) (化学システム工学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2E (2.0credits) (化学システム工学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Akira ITO Professor	Yasuhito MUKAI Associate Professor	Masahiro KANEKO Assistant Professor

●Course Purpose
The state-of-the-art of sciences and technologies on separation and fusion system engineering will be discussed. By the end of the course, students should be able to do the following: 1. Learn research methods related to separation and fusion system engineering and to apply them in engineering: 2. Understand and explain theory and models related to separation and fusion systems engineering.

●Prerequisite Subjects
Separation Systems, Multiphase Flow, Fluid Flow with Exercises

●Course Topics
To deepen the understanding of the latest literature on separation and fusion system engineering by conducting 1. searching papers, 2. reading and understanding, 3. creating reports, 4. presenting and 5. discussing. The presenter must prepare for the presentation.

●Textbook
The paper will be prepared by the presenter.

●Additional Reading
Indicated during class if necessary.

●Grade Assessment
Reports and Oral examinations

●Notes
No requirements.

●Contacting Faculty
Accepted anytime, also via email.

Seminars on Chemical Systems Engineering 2E (2.0credits) (化学システム工学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	KATSUTOSHI Nagaoka Professor	Noriyuki KOBAYASHI Associate Professor	Hiroshi YAMADA Assistant Professor

●Course Purpose

Purpose of this course is to understanding catalytic chemistry, reaction engineering, a thermochemical study field by investigation of academic papers, its presentation, and discussion. Students will acquire the following knowledge, and ability in the end of the class.

1. Understanding the trend of the study field and being able to explain it.
2. Understanding the science and technology, the problem of the study field and being able to suggest the solution to the problem.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Chemical Systems Engineering 2E (2.0credits) (化学システム工学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Hideki KITA Professor	Yoshihiro KOJIMA Associate Professor	Seiichi DEGUCHI Lecturer
	Mitsuhiro KUBOTA Assistant Professor		

●Course Purpose
Understand various thermal fluids and movement phenomena related to energy conversion and utilization, and improve problem solving ability. It also covers environmental management-related waste treatment technologies and technologies related to thermal management, such as heat storage, heat insulation, heat transfer, and heat pumps.

●Prerequisite Subjects
Fluid dynamics, thermodynamics, heat transfer engineering, transfer phenomenology

●Course Topics
Deepen understanding by reading related literature and discussing research.

●Textbook
none.Appropriate handouts will be given.

●Additional Reading
Introduce as appropriate.

●Grade Assessment
Comprehensive evaluation of goal achievement through oral presentation (50 points), report (30 points) and Q & A / discussion (20 points). A+:100-95A:94-80B:79-70C:69-65C-:64-60F:59 points or less.

●Notes
No course requirements are required.

●Contacting Faculty
Accept questions as appropriate during class hours and in the office.

Seminars on Chemical Systems Engineering 2E (2.0credits) (化学システム工学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Koyo NORINAGA Professor	KeijiYASUDA Associate Professor	HiroshiMACHIDA Assistant Professor

●Course Purpose

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2A (2.0credits) (材料化学セミナー２A)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	1 Spring Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose
In this seminar, we will give a small theme related to a future problem and a doctoral dissertation, and prepare a solution for it, thereby conducting training to build academics and demonstrate originality.
The goal is for students to achieve the following through this seminar.
1. The problem of various thermoelectric materials and thermoelectric power generation systems can be solved based on the basis of physical chemistry and process engineering.

●Prerequisite Subjects
Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering, Non-equilibrium Themodynamics

●Course Topics
In this seminar, small themes will be selected from the themes of the doctoral dissertation of the students and the problems in various fields related to thermoelectric conversion materials and thermoelectric power generation systems, which are considered to be future problems at that time.

Out-hours learning:
Prepare and understand the contents of the next selected small theme.

●Textbook
Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading
Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment
Degree of achievement is evaluated by written report (50%), oral presentation (25%), and discussions(25%).
A pass is accepted if students can solve various thermoelectric materials and thermoelectric power generation system problems based on the basics of physical chemistry and process engineering, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes
No course requirements are required.

●Contacting Faculty
In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 2A (2.0credits) (材料化学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 2A (2.0credits) (材料化学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2A (2.0credits) (材料化学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer for their phD thesis.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 2A (2.0credits) (材料化学セミナー２A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Spring Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science exploiting informatics. Performance targets: To get abilities as follows: (i) To have comprehensive views on materials informatics and machine learning including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required. (1) The attendees are required to read the latest papers related to organic materials chemistry and organic solar cells.(2) The attendees are required to read the latest papers related to energy conversion devices and related materials.(3) The attendees are required to read the latest papers related to information and materials sciences.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 2B (2.0credits) (材料化学セミナー２B)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	1 Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, we will give a small theme related to a future problem and a doctoral dissertation, and prepare a solution for it, thereby conducting training to build academics and demonstrate originality.
The goal is for students to achieve the following through this seminar.
1. The problem of various thermoelectric materials and thermoelectric power generation systems can be solved based on the basis of physical chemistry and process engineering.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering, Non-equilibrium Themodynamics

●Course Topics

In this seminar, small themes will be selected from the themes of the doctoral dissertation of the students and the problems in various fields related to thermoelectric conversion materials and thermoelectric power generation
systems, which are considered to be future problems at that time.

Out-hours learning:
Prepare and understand the contents of the next selected small theme.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Degree of achievement is evaluated by written report (50%), oral presentation (25%), and discussions(25%).
A pass is accepted if students can solve various thermoelectric materials and thermoelectric power generation system problems based on the basics of physical chemistry and process engineering, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 2B (2.0credits) (材料化学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 2B (2.0credits) (材料化学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2B (2.0credits) (材料化学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer for their phD thesis.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 2B (2.0credits) (材料化学セミナー２B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	1 Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities as follows: (i) To have comprehensive views on including its history and latest trends. (ii) To list up technical challenges to be solved. (iii) To generate new research themes and ideas.(3) The purpose of the course is to acquire the basic knowledge, comprehensions, and incentive that are required to bridge between information and material sciences. Performance targets: To get abilities as follows: (i) To understand existing research issues and develop them to solve the problems. (ii) To acquire interdisciplinary knowledge and propose new methods.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required. (1) The attendees are required to read the latest papers related to organic materials chemistry and organic solar cells.(2) The attendees are required to read the latest papers related to energy conversion devices and related materials.(3) The attendees are required to read the latest papers related to information and materials sciences.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in

Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building. (3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 2C (2.0credits) (材料化学セミナー２C)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	2 Spring Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, we will give a small theme related to a future problem and a doctoral dissertation, and prepare a solution for it, thereby conducting training to build academics and demonstrate originality.
The goal is for students to achieve the following through this seminar.
1. The problem of various thermoelectric materials and thermoelectric power generation systems can be solved based on the basis of physical chemistry and process engineering.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering, Non-equilibrium Thermodynamics

●Course Topics

In this seminar, small themes will be selected from the themes of the doctoral dissertation of the students and the problems in various fields related to thermoelectric conversion materials and thermoelectric power generation
systems, which are considered to be future problems at that time.

Out-hours learning:
Prepare and understand the contents of the next selected small theme.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Degree of achievement is evaluated by written report (50%), oral presentation (25%), and discussions(25%).
A pass is accepted if students can solve various thermoelectric materials and thermoelectric power generation system problems based on the basics of physical chemistry and process engineering, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 2C (2.0credits) (材料化学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 2C (2.0credits) (材料化学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2C (2.0credits) (材料化学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer for their phD thesis.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 2C (2.0credits) (材料化学セミナー２C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Spring Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities to grasp the research problems and envision concrete approach to solve them.(2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities to grasp the research problems and envision concrete approach to solve them.(3) The purpose of the course is to acquire the basic knowledge, comprehensions, and incentive that are required to bridge between information and material sciences. Performance targets: To get abilities to grasp the research problems and envision concrete approach to solve them.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) The attendees are required to read the latest papers related to organic materials chemistry and organic solar cells.(2) The attendees are required to read the latest papers related to energy conversion devices and related materials.(3) The attendees are required to read the latest papers related to information and materials sciences.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call

via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building.
(3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 2D (2.0credits) (材料化学セミナー２D)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	2 Autumn Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, we will give a small theme related to a future problem and a doctoral dissertation, and prepare a solution for it, thereby conducting training to build academics and demonstrate originality.
The goal is for students to achieve the following through this seminar.
1. The problem of various thermoelectric materials and thermoelectric power generation systems can be solved based on the basis of physical chemistry and process engineering.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering, Non-equilibrium Thermodynamics

●Course Topics

In this seminar, small themes will be selected from the themes of the doctoral dissertation of the students and the problems in various fields related to thermoelectric conversion materials and thermoelectric power generation
systems, which are considered to be future problems at that time.

Out-hours learning:
Prepare and understand the contents of the next selected small theme.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Degree of achievement is evaluated by written report (50%), oral presentation (25%), and discussions(25%).
A pass is accepted if students can solve various thermoelectric materials and thermoelectric power generation system problems based on the basics of physical chemistry and process engineering, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 2D (2.0credits) (材料化学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 2D (2.0credits) (材料化学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2D (2.0credits) (材料化学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	Nobuki YUKAWA Associate Professor	Wataru NORIMATSU Associate Professor	Eiji ABE Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer for their phD thesis.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 2D (2.0credits) (材料化学セミナー２D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	2 Autumn Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities to achieve the research goal and compose a dissertation. (2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities to achieve the research goal and compose a dissertation. (3) The purpose of the course is to acquire the basic knowledge, comprehensions, and incentive that are required to bridge between information and material sciences. Performance targets: To get abilities to develop unique methodology to achieve the research goal.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) The attendees are required to read the latest papers related to organic materials chemistry and organic solar cells.(2) The attendees are required to read the latest papers related to energy conversion devices and related materials.(3) The attendees are required to read the latest papers related to information and materials sciences.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building.

(3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

Seminars on Materials Chemistry 2E (2.0credits) (材料化学セミナー２E)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Chemical Systems Engineering
Starts 1	3 Spring Semester
Lecturer	"Takashi ITOH" Associate Professor

●Course Purpose

In this seminar, we will give a small theme related to a future problem and a doctoral dissertation, and prepare a solution for it, thereby conducting training to build academics and demonstrate originality.
The goal is for students to achieve the following through this seminar.
1. The problem of various thermoelectric materials and thermoelectric power generation systems can be solved based on the basis of physical chemistry and process engineering.

●Prerequisite Subjects

Chemistry I, II, Physical Chemistry 1 - 4, Heat Transfer and Diffusion, Material Process Engineering, Non-equilibrium Thermodynamics

●Course Topics

In this seminar, small themes will be selected from the themes of the doctoral dissertation of the students and the problems in various fields related to thermoelectric conversion materials and thermoelectric power generation
systems, which are considered to be future problems at that time.

Out-hours learning:
Prepare and understand the contents of the next selected small theme.

●Textbook

Textbooks are not used. Prints will be distributed as needed.
The documents to be read are selected as appropriate as the seminar progresses.

●Additional Reading

Reference books will be introduced as appropriate as the process progresses.

●Grade Assessment

Degree of achievement is evaluated by written report (50%), oral presentation (25%), and discussions(25%).
A pass is accepted if students can solve various thermoelectric materials and thermoelectric power generation system problems based on the basics of physical chemistry and process engineering, and the results will be reflected accordingly, if students can deal with more difficult matters.
Total points of 60% is required at the least.

●Notes

No course requirements are required.

●Contacting Faculty

In case of questions: Make contact to
Assoc. Prof. Itoh: itoh.takashi@material.nagoya-u.ac.jp

Seminars on Materials Chemistry 2E (2.0credits) (材料化学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Ryouichi ICHINO Professor	Hiroaki MATSUMIYA Associate Professor	TakeshiHAGIO Assistant Professor

●Course Purpose

The aim of this course is to help students acquire an understanding of materials sciences and engineering from the viewpoint of environmental protection. The understanding will be deepened by making literature review of recent journal papers. Through the course, students will develop a deep understanding of the recent developments of environmental low-impact materials and their processing, including chemical separation techniques, and students will extend their capabilities of planning, conducting, and completing their research works.

●Prerequisite Subjects

Physical Chemistry (1-4), Material Processing, Fundamentals of Chemistry (1&2)

●Course Topics

Literature survey, presentation and discussion on environmental low-impact materials and their processing and recycling, including chemical separation techniques.

●Textbook

Specified as needed during the seminar

●Additional Reading

Specified as needed during the seminar

●Grade Assessment

Both of presentation and discussion are evaluated for the grade judgement. To pass, students must earn at least 60 points out of 100. It is required to understand and explain the recent developments of environmental low-impact materials and their processing and recycling.

●Notes

●Contacting Faculty

During the seminar or at the office upon resevation.

Seminars on Materials Chemistry 2E (2.0credits) (材料化学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Nagahiro Saito Professor	KAMIMOTO Yuki Associate Professor	Junko HIEDA Associate Professor
	Tomonaga UENO Assistant Professor		

●Course Purpose

Students will acquire the physical chemistry and process science required for material chemistry processes. In addition, the latest research articles will be introduced in order to touch the latest reserch fields and deepen understanding through oral presentations, so that feedback will be given to individual research.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Seminars on Materials Chemistry 2E (2.0credits) (材料化学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	Tetsuya Yamamoto Associate Professor	Wataru NORIMATSU Associate Professor	Toshihira IRISAWA Assistant Professor

●Course Purpose

In this seminar, students are required to read and understand the English original research paper about the low-dimensional materials, present about the contents of the paper, and discuss about them with the other students and the lecturer for their phD thesis.

●Prerequisite Subjects

●Course Topics

●Textbook

Materials will be distributed in the class

●Additional Reading

Graphene Fundamentals and emergent applications, J. M. Warner, et al., Elsevier, 2013.
Epitaxial Graphene on Silicon Carbide, G. Rius, et al., Pan Stanford Publishing, 2018.
Physical and Chemistry of Graphene Graphene to Nanographene, T. Enoki, et al., Jenny Stanford Publishing, 2019.
Handbook of Graphene Growth, Synthesis, and Functionalization, E. Celasco, et al., Wiley, 2019.
Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer, 2009.

●Grade Assessment

●Notes

●Contacting Faculty

By e-mail

Seminars on Materials Chemistry 2E (2.0credits) (材料化学セミナー２E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Chemical Systems Engineering		
Starts 1	3 Spring Semester		
Lecturer	YutakaMATSUO Professor	Masaya KAWASUMI Designated Professor	Akihisa ICHIKI Designated Associate Professor

●Course Purpose

(1) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research from materials chemistry of organic semiconductors to application research on organic solar cells for energy conversions. Performance targets: To get abilities to achieve the research goal and compose a dissertation. (2) The purpose of the course is to acquire the ability to generate new research themes valuable both in society and academia via comprehension of prior research on materials science and technologies related to electrochemical devices for energy conversions. Performance targets: To get abilities to achieve the research goal and compose a dissertation. (3) The purpose of the course is to acquire the basic knowledge, comprehensions, and incentive that are required to bridge between information and material sciences. Performance targets: To get abilities to achieve the research goal and compose a dissertation.

●Prerequisite Subjects

(1) Fundamental understandings of organic chemistry, inorganic chemistry, physical chemistry, and applied physics.(2) Fundamental understandings of chemical engineering, electrochemistry, inorganic and organic materials.(3) Fundamental understandings of computer programming, mechanics, linear algebra and computational materials science are helpful.

●Course Topics

Reading references in advance is required.(1) The attendees are required to read the latest papers related to organic materials chemistry and organic solar cells.(2) The attendees are required to read the latest papers related to energy conversion devices and related materials.(3) The attendees are required to read the latest papers related to information and materials sciences.

●Textbook

There is no prescribed textbook. Important handouts/papers will be given or chosen as needed during the seminar.

●Additional Reading

(1) “Science of Organic Thin-Film Solar Cells”, Yutaka Matsuo, Kagakudojin.(2) “Recent chemical engineering 67 Evolving fuel cells and secondary batteries”, Japan Society for Chemical Engineering, Kanto Branch Edit.(3) “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006.

●Grade Assessment

The levels attained will be evaluated via performance of presentations (50%) and discussions (50%) during the seminar.

●Notes

There is no requirement to take this course on each research group.

●Contacting Faculty

(1) Any questionnaires are welcome during and after the seminar, or separately via e-mail: yutaka.matsuo@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6722 at the Room No.305 in Materials Research Laboratory for Green Vehicle Building.(2) Any questionnaires are welcome during and after the seminar, or separately via e-mail: masaya.kawasumi@chem.material.nagoya-u.ac.jp or phone call via intra-office No.4643 at the Room No.309 in Materials Research Laboratory for Green Vehicle Building.

(3) Any questionnaires are welcome during and after the seminar, or separately via e-mail: ichiki@chem.material.nagoya-u.ac.jp or phone call via intra-office No.6868 at the Room No.212 in Materials Research Laboratory for Green Vehicle Building.

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	
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	
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	
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	
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	
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	
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	
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 daysin 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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 review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter 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	
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

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	
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

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.