

Core Inorganic Chemistry (2.0credits) (コア無機化学特論)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

"In this course, students will learn Physical theories that predict structures and reaction pathways of chemical compounds. For this purpose, students will learn basic concepts of the group theory in the first half of this course. Students will learn various point groups, structures of character tables, and basic mathematical techniques related to the group theory.

Then students will learn first- and second-order Jahn-Teller effects that are related to the distortions of ground-state structures and the activation energy of chemical reactions. Finally, the students will learn symmetry rules that determine the pathways of reactions.

By taking this course, students will understand (1) symmetry elements and symmetry operations of various point groups; (2) methods of mathematical calculations using character tables; (3) method to draw molecular orbital by obtaining group orbitals; (4) analyses of normal mode vibrations of simple molecules by leaning the whole molecule method and internal coordinate method; (5) judgment if a given dipole transition is allowed or not; (6) determinations of ground-state structures of various compounds; and (7) judgment if a given reaction is allowed to proceed thermally / photochemically or not. Students also learn about basic mathematics related to the projection operators and the Great Orthogonality Theorem."

Prerequisite Subjects

Undergraduate Quantum Chemistry and Inorganic Chemistry courses

Course Topics

1. Symmetry elements / operations and point groups
2. Structure of character tables, reducible and irreducible representations, and direct product
3. Kugel Group and subgroup
4. Application of Group Theory 1: group orbital and molecular orbital
5. Application of Group Theory 2: analyses of normal mode vibrations and basic concepts of IR / Raman spectroscopy
6. Application of Group Theory 3: judgments of electronic / IR / Raman transitions
7. Application of Group Theory 4: Jahn-Teller Theorem and structures of compounds
8. Application of Group Theory 5: Allowed and forbidden reactions; Adiabaticity of concerted processes; Symmetry Rules and Principle of Least Motion"

Textbook

Theories for Structures and Reactions; A Practical Guide to the Physical Theories in Chemistry (by HDT)

Additional Reading

S.F.A. Kettle, Symmetry and Structure – a Readable Group Theory for Chemists, Wiley, and other books referred to in the textbook.

Grade Assessment

Grading will be based on attendance, reports, and exam.

Notes

No registration requirements

Contacting Faculty

Phone: 789-5473 E-mail: h.d.takagi@nagoya-u.jp Class Room SA322

Core Organic Chemistry (2.0credits) (コア有機化学特論)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

The purpose of this course is to learn systematically important features of basic/advanced organic chemistry. This course will assist the student to understand the intellectual roots of organic chemistry under the specific topics selectively chosen in basic/advanced organic chemistry and to develop the knowledge and appreciation of the organic molecular structures, characterizations, preparations, and reactions, as well as the corresponding mechanisms in organic chemistry. Students will be able to solve progressive problems in organic chemistry sequentially.

Prerequisite Subjects

The students are recommended to have background knowledge in fundamentals of chemistry, inorganic chemistry, organic chemistry, and physical chemistry.

Course Topics

Class 1. Molecular Orbitals and the Perspective of Molecular Structures and Isomers
Class 2. General Trend of Chemical Reactivity for Organic Compounds
Class 3. Saturated & Unsaturated Aliphatic Molecules and Extended π -Electron Systems
Class 4. Stereochemistry of the Fundamental Organic Reactions and the Corresponding Mechanisms
Class 5. Chemical Kinetics and Thermodynamics in Chemical Reactions of Organic Compounds
Class 6. Overview of Molecular Spectroscopy
Class 7. Spectroscopic Assignments of Organic Compounds
Class 8. Functional Groups and their Reactivities
Class 9. Reactive Functional Groups and Reactivity Managements
Class 10. Photochemical Ionic Reactions: Aromatic Nucleophilic/Electrophilic Substitutions
Class 11. Structure, Preparation, and Reactivity of Heterocycles
Class 12. Thermal and Photochemical Pericyclic Reactions
Class 13. Rearrangement Reactions of Organic Molecules
Class 14. Organometallic Compounds and Transition Metal Catalysis
Class 15. Student Presentations and the Assessments

Textbook

- Organic Chemistry: Structure and Function (Seventh Edition), Peter Vollhardt and Neil Schore, W. H. Freeman and Company, New York, 2014.
- Molecular Orbitals and Organic Chemical Reactions (Reference Edition), Ian Fleming, John Wiley & Sons, Ltd. 2010.

Additional Reading

- Organic Chemistry (Second Edition), Jonathan Clayden, Nick Greeves, and Stuart Warren, Oxford Univ. Press, 2012.
- Organometallic Chemistry (Second Edition), Gary O. Spessard and Gary L. Miessler, Oxford Univ. Press, 2010.
- Advanced Organic Chemistry (Part B: Reaction and Synthesis, Fifth Edition), Francis A. Carey, Richard J. Sundberg, Springer, 2007.

Grade Assessment

Grades will be based on the assessment of reports (60%) and presentation (40%) Credits will be awarded to those students who score 60 or more: Grades are as follows: S:100-90, A:89-80, B:79-70, C:69-60, F:59-0.

Notes

In the cases of any unavoidable reason such as sickness, accident, or no attendance school to contribute presentations in the conferences related to the research project of the student, the student may not have a penalty with the absence. Also, the student may get the grade of 'Absent' through the judgement between the course instructor and the student, when the student submits a 'Course Withdrawal Request' to receive the 'Absent' grade. However, no submission of the report for sickness/absence and the lack of attendance score may result in 'F' grade (over 1/3). It is for protection of other attendances of the course from the frequent absence of the specific/uncertain student(s).

Contacting Faculty

Students can communicate with their course instructor face-to-face either in their classes or appointment times. Communication through emails (instructor's email: jyshin@biochem.nagoya-u.ac.jp) are also available.

Core Physical Chemistry (2.0credits) (コア物理化学特論)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The purpose of the course is to review formerly acquired knowledge of Physical Chemistry and apply it to solving problems in chemistry and biochemistry. Solving problems in the class and at home is the focus of this course, which will prepare the student for their careers in Chemistry.

Prerequisite Subjects

Fundamentals of Physics I to IV, Calculus I and II, Linear Algebra I and II, Physical Chemistry I and II, Quantum Chemistry I and II or permission of the instructor

Course Topics

I. EQUILIBRIUM THERMODYNAMICS

- 1 Review of the fundamental concepts and the three laws (Ch. 1 - 2)
- 2 Review of the fundamental concepts and the three laws (Ch. 2 - 3)
- 3 Pure substances and simple mixtures (Ch. 4 - 5)
- 4 Chemical equilibrium (Ch. 6)
- 5 EXAM 1 (Chs. 1 - 6)

II. STATISTICAL THERMODYNAMICS

- 6 Review of the concepts: the distribution of molecular states; the internal energy and the entropy; the canonical partition function (Ch. 15)
- 7 Review of the concepts: the distribution of molecular states; the internal energy and the entropy; the canonical partition function (Ch. 15)
- 8 The applications: the molecular partition function; mean energies; molecular interactions in liquids; equilibrium constants (Ch. 16)
- 9 EXAM 2 (Chs. 1 - 6)

III. QUANTUM THEORY

- 10 The principles and applications: the Schrodinger equation; the Born interpretation; the Postulates; a particle in the box; vibration and rotation in 2D & 3D (Ch. 7 - 8)
- 11 Atomic structure and spectra: from hydrogenic atoms to complex atoms (Ch. 9)
- 12 Molecular structure and spectroscopy: the Born-Oppenheimer approximation; valence-bond theory; molecular orbital theory; the Huckel approximation for polyatomic systems (Ch. 10 - 11)
- 13 Molecular structure and spectroscopy: the Born-Oppenheimer approximation; valence-bond theory; molecular orbital theory; the Huckel approximation for polyatomic systems (Ch. 11 - 12)
- 14 Pre-exam Review
- 15 FINAL EXAM (Ch. 1 - 12, 15 & 16)

Textbook

P. Atkins and J de Paula: Atkins' Physical Chemistry, 11th Ed., Oxford University Press, 2018

Additional Reading

Grade Assessment

"Two midterm exams - 100 points each, final exam (comprehensive) - 100, homework and class participation - 200. TOTAL: 500.

Grade "S": 100-90% (450 or more points), "A": 89-80% (449 - 400 pts), "B": 79-70% (399 - 350 pts), "C": 69-60% (349- 300 pts), "F": 59-0% (fewer than 299 pts)."

Core Physical Chemistry (2.0credits) (コア物理化学特論)

It is essential to sit in each exam during the scheduled class time. There will be NO make-up exam. In the event of a missed exam due to a serious illness, accident or family emergency, compelling written documentation of the reason for the absence will be required. If the reason is accepted, the final grade will be calculated from the appropriately weighted average from the rest of the exams. If the reason will be deemed insufficient, the absence will be unexcused, and zero points will be awarded for the missed exam. WARNING: Missing more than one exam (it does not matter whether excused or not) means automatically failing the course.

Notes

Contacting Faculty

Phone: 789-2480 E-mail: pbutko@chem.nagoya-u.ac.jp

Core Biochemistry (2.0credits) (コア生物化学特論)

Course Type	Basic Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim of this course is to gain an understanding of basic principles as well as the latest topics in various fields of biochemistry, including protein chemistry, peptide chemistry, nucleic acid chemistry, genetic engineering, molecular biology, synthetic biology, bioinorganic chemistry, nanobioscience, bioengineering, structural biology, and bioinformatics.

Prerequisite Subjects

not in particular, but basic knowledge of biology is necessary

Course Topics

1. protein chemistry, peptide chemistry
2. nucleic acid chemistry
3. genetic engineering, molecular biology
4. synthetic biology, bioinorganic chemistry
5. nanobioscience, nanobiotechnology
6. bioengineering, bioinformatics
7. structural biology

Textbook

basically nil. Each teacher might specify the textbooks and references from time to time

Additional Reading

nil

Grade Assessment

Evaluation of Reports

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

Notes

not in particular

Contacting Faculty

In communicate with the instructor by face-to-face in the lecture or in the office hour, and by e-mail.

Chemistry Seminar 1A (2.0credits) (化学系セミナー 1 A)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literatures in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 1B (2.0credits) (化学系セミナー 1 B)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 1C (2.0credits) (化学系セミナー 1 C)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	2 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 1D (2.0credits) (化学系セミナー 1 D)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	2 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

Lectures on chemical reaction, synthesis, microstructure and property control of inorganic and related materials (especially advanced nanostructured-materials) will be given based on solid state chemistry and nanotechnology.

Prerequisite Subjects

Inorganic Chemistry 1 with Exercises
 Inorganic Chemistry 2 with Exercises
 Chemistry of Inorganic Reaction
 Inorganic Material Chemistry

Course Topics

1. Introduction
 2. Nanoporous metal complexes and related materials: Synthesis, structures and properties
 3. Porous materials prepared via sol-gel methods accompanied by phase separation
 4. Mesoporous materials: synthesis and applications
 5. Solid oxide fuel cells: Materials, processing and applications
 6. Colloidal nanoparticles for biomedical applications
 7. Bioceramics: Ceramics in medicine, biology and biomimetics
 8. Chemically designed nanomaterials: Synthesis and properties
 9. Synthesis of inorganic materials with high performance
- On each lecture, reference information such as scientific paper will be given.

Textbook

Textbooks are not designated. Prints are distributed when necessary.

Additional Reading

- [1] "Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (2nd Edition)", Guozhong Cao and Ying Wang, World Scientific, 2010.
 - [2] "Ceramic Materials: Science and Engineering (1st Edition)", C. Barry Carter, M. Grant Norton, Springer, 2007.
 - [3] "Solid State Chemistry: An Introduction (3rd Edition)", Lasley E. Smart, Elaine A. Moore, Taylor and Francis, 2005.
 - [4] "Solid State Chemistry and its Applications (2nd Edition)", Anthony R. West, Wiley, 2014.
- When necessary, other textbooks will be introduced.

Grade Assessment

Materials and reaction on each lecture should be understood properly.

Reports and examination credits will be awarded to those students who score 60 or more. Grades are as follows:

<Enrollees after 2020>

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

<Enrollees before 2019>

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

Notes

Not applicable.

Contacting Faculty

Contact each professor directly. Details will be given on each lecture.

Advanced Organic Chemistry (2.0credits) (アドバンス有機化学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

The purpose of this course is to present an overview of cutting-edge organic chemistry, and learn important principles and facets of modern chemistry. The course includes sophisticated catalysts and reagents (organic-based and metal-based) for making useful compounds, designer functional organic molecules with various optoelectronic properties, and synthesis of natural products and biologically active complex molecules.

Prerequisite Subjects

Organic Chemistry 1-5

Course Topics

1. Organocatalysts for Green Chemistry
2. Chiral Catalysts for Enantioselective Synthesis
3. Transition Metal Catalysts for Unreactive Bond Activation
4. Synthesis of Optoelectronic Materials
5. Synthesis of Natural Products and Biologically Active Compounds

Textbook

Not specified.

Additional Reading

Organic Chemistry: Structure and Function 6th ed. K. Peter C. Vollhardt, Neil E. Schore"

Grade Assessment

Grades will be based on reports. Grades: A+: 100-90% , A: 89-80% , B: 79-70%, C: 69-65%, C-: 64-60%, F:59-0%.

Notes

No course requirements

Contacting Faculty

Students can communicate with their lecturers during lectures, office hours, or via email.

Advanced Physical Chemistry (2.0credits) (アドバンス物理化学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

This course is designed as a broad survey of modern topics in physical chemistry through an omnibus form of lectures conducted by Professors, Associate Professors, and Lecturers. The teachers will provide the latest stimulative topics in physical chemistry such as carbon nanotubes, graphenes, organometallics, nanoparticles, electronic devices, catalysts, solar cells, etc. All the lectures will help you to have your overview of physical chemistry for understanding the essence of the modern physical chemistry.

Prerequisite Subjects

The course assumes students have background knowledge of general principles of chemistry, inorganic chemistry, organic chemistry, quantum chemistry, thermodynamics, chemical kinetics and electrochemistry.

Course Topics

The lecturers will provide you specifics from the cutting-edge topics such as surfaces/interfaces chemistry, science of nanomaterials, electronic band structure, laser chemistry, computer simulation, catalysis chemistry, molecule-based spintronics, solvation theory, etc.

Textbook

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

Additional Reading

Appropriate reference books will be introduced by each instructor.

Grade Assessment

Required work consists of homework assignments. Students must submit reports to each teacher.

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

- Every assignment and attitude: 100%

Credits will be awarded to those students who score 60 or more out of 100 points. Grades are as follows:

Enrollees after 2020

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

Enrollees before 2019

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

Notes

No course requirements are required.

Contacting Faculty

The teacher in charge of each class will answer student's questions individually.

Office hours: Monday to Friday, 9:00 to 17:00.

(An appointment must be required by e-mail.)

Advanced Quantum Chemistry (2.0credits) (アドバンス量子化学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

The accurate description of the electronic structure of large molecules is an important topic in the field of quantum chemistry, and is required for the accurate understanding of chemical phenomena. In this class, theoretical concepts for large-scale calculations will be covered.

Prerequisite Subjects

Quantum Chemistry I & II

Course Topics

1. Born-Oppenheimer approximation
2. LCAO-MO theory: Hartree-Fock theory
3. Electron correlation problem
4. Basis sets in quantum chemical calculations
5. Intermolecular interactions
6. Molecular mechanics
7. How to treat large number of particles (QM/MM, FMO, and DC)

Participants should have some familiarity with electronic-structure theory and/or molecular dynamics techniques.

Textbook

Will be introduced in the class.

Additional Reading

Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory (A. Szabo and N.S. Ostlund), Dover Publications, Inc.;

Grade Assessment

Final examination and attendance

Notes

No registration requirements

Contacting Faculty

Please contact each lecturer.

Advanced Polymer Chemistry (2.0credits) (アドバンス高分子化学)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The purpose of this course is to learn important topics of polymer science. The course begins with basic concepts of polymer, proceeds next to polymerization and synthesis of various polymers, and moves then to characterization, structures, properties, and functions of polymers, and biopolymers.

Upon taking this course, you aim to learn important topics of polymer science, such as what polymers are, how to make polymers, how to characterize polymer properties, how properties are affected by polymer structures, how to design functional polymers, and how biopolymers are different from synthetic polymers. You will get basic knowledge on polymer chemistry first and then abilities to apply the basic knowledge to creating new polymer materials.

Prerequisite Subjects

Fundamentals of Chemistry, Organic Chemistry, Physical Chemistry, Analytical Chemistry, Biochemistry

Course Topics

1. Introduction to Polymer
2. Step-Growth Polymerization
3. Free-Radical Addition Polymerization
4. Ionic Polymerization
5. Linear Copolymers and Other Architectures
6. Polymer Stereochemistry
7. Polymerization Reactions Initiated by Metal Catalysts and Transfer Reactions
8. Polymers in Solution
9. Polymer Characterization – Molar Masses
10. Polymer Characterization – Chain Dimensions, Structures, and Morphology
11. The Crystalline State and Partially Ordered Structures
12. The Glassy State and Glass Transition
13. Rheology and Mechanical Properties
14. The Elastomeric State
15. Structure-Property Relations
16. DNA and RNA that Encode Genetic Information as their Sequences
17. Higher-Order Structures of Polypeptides and Protein

Prior to taking each class, read the corresponding part of the textbook. After taking the class, solve the problems in the textbook by yourself. During each class, solve the quizzes.

Textbook

Polymers: Chemistry and Physics of Modern Materials (J. M. G. Cowie and Valeria Arrighi), 3rd Edition; CRC Press

Additional Reading

Principles of Polymerization (G. Odian), 4th Edition, Wiley-Interscience

Grade Assessment

Quizzes during classes.

Credits will be awarded to those students who understand basics on synthetic and bio-based polymers, polymerization, polymer characterization, structures, properties, and functions. Advanced understandings will be considered.

Notes

There are no requirements for taking this course.

Contacting Faculty

Students can communicate with their lecturers after lectures.

Experiments and Exercises in Chemistry I (4.0credits) (化学系特別実験及び演習)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Practice
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

Objectives and any other requirements for this course depend on the laboratory where students belong (refer to the course syllabus at each lab.)

Prerequisite Subjects

Fundamental understandings of required chemistry courses

Course Topics

The contents of this course depend on the laboratories where students belong (refer to the course syllabus at each lab.)

Textbook

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

Additional Reading

Some instructive references will be informed by the lecturer during the classes.

Grade Assessment

The levels attained will be evaluated via performance in preparation for the graduate work.

Notes

No registration requirements

Contacting Faculty

Any questionnaires are welcome during and after the seminar and experiments or separately via email

Experiments and Exercises in Chemistry II (4.0credits) (化学系特別実験及び演習)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Experiment and Practice
Course Name	Graduate Chemistry
Starts 1	2 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

Objectives and any other requirements for this course depend on the laboratory where students belong(refer to the course syllabus at each lab.)

Prerequisite Subjects

Fundamental understandings of required chemistry courses

Course Topics

The contents of this course depend on the laboratories where students belong(refer to the course syllabus at each lab.)

Textbook

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

Additional Reading

Some instructive references will be informed by the lecturer during the classes.

Grade Assessment

The levels attained will be evaluated via performance in preparation for the graduate work.

Notes

No registration requirements

Contacting Faculty

Any questionnaires are welcome during and after the seminar and experiments or separately via email

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	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Part-time Faculty

Course Purpose

In this course, students will improve their ability to summarize research findings in English, submit a paper to an international academic journal, and make an English presentation at an international conference.

Prerequisite Subjects

Various subjects relating to English

Course Topics

1. Grammar for writing a scientific paper 2. How to write scientific papers 3. Public speaking before international audiences 4. Self-evaluation: writing effective CVs and job applications 5. E-mail for technical and business purposes

Textbook

Additional Reading

Ishida et al., How to Write Scientific English and Make Presentations (in Japanese), Corona Publishing Co. Ltd.

Grade Assessment

Grades will be based on assessment of presentation quality, active participation in audience discussion, and attendance.

Notes

Contacting Faculty

Introduction to Academic Communication (1.0credits) (コミュニケーション学)

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

Course Purpose

Students will learn presentation skills for academic purposes, which may include giving academic presentations.

Japanese students are expected to present in English and international students in Japanese in the seventh or eighth class meeting.

By taking this class, students are expected to be able to do the following:

- Give a solid presentation with confidence and without hesitation
- Grasp the characteristics of successful presentations
- Use techniques learned in class in their own presentation

Prerequisite Subjects

English language classes for Japanese students

Japanese language classes for international students

Course Topics

- (1) Ways to convey messages in presentation
- (2) The language of a presentation
- (3) Tips for making effective slides
- (4) Observation and analysis of video-taped presentation by a past student
- (5) Paper vs presentation
- (6) Preparation for individual presentation
- (7) Individual presentations I

(8) Individual presentations

This course requires students to work outside of the classes for individual presentation.

Textbook

Handouts will be distributed in class

Additional Reading

1The Japan Times

2:

Grade Assessment

Individual presentation: 50%

Active class participation: 50%

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

Grading will be decided based on the ability to give an effective academic presentation.

Notes

There are no requirements for taking this class.

Contacting Faculty

Questions will be answered before class, in class, after class or by e-mail.

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

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for 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

Depends on each research group of the student and the internship company

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

Depends on each research group of the student and the internship company

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

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

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for 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

Depends on each research group of the student and the internship company

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

Depends on each research group of the student and the internship company

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

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

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for 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

Depends on each research group of the student and the internship company

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

Depends on each research group of the student and the internship company

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

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

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for 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

Depends on each research group of the student and the internship company

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

Depends on each research group of the student and the internship company

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

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

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for 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

Depends on each research group of the student and the internship company

Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

Textbook

not specified.

Additional Reading

not specified.

Grade Assessment

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

Notes

Depends on each research group of the student and the internship company

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 1 U2)

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'. Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

Depends on mutual laboratories

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

Depends on mutual laboratories

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

Depends on mutual laboratories

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'. Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

Depends on mutual laboratories

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'. Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

Depends on mutual laboratories

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

Chemistry Seminar 2A (2.0credits) (化学系セミナー2A)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 2B (2.0credits) (化学系セミナー2B)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	1 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 2C (2.0credits) (化学系セミナー2C)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	2 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 2D (2.0credits) (化学系セミナー2D)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	2 Spring Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry Seminar 2E (2.0credits) (化学系セミナー2E)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Seminar
Course Name	Graduate Chemistry
Starts 1	3 Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

In this class, we will perform the discussions on the reference books or literature in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. Students will obtain application ability, a process of the study, and a way of thinking about the inventions.

Prerequisite Subjects

All classes on chemistry and biochemistry

Course Topics

Presentation and discussion on recent relevant literatures. Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Material Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, Eco Nano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design.

Textbook

Textbooks and papers will be suggested in each research group.

Additional Reading

References will be introduced in the class.

Grade Assessment

Depend on research group. Evaluations are based on seminar discussions and reports. Credits will be awarded to those students who score 60 or more.

Notes

Depends on research groups.

Contacting Faculty

Ask to the corresponding Professors in each research group.

Topics in International Chemistry 10 (1.0credits) (国際化学特論)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Starts 2	2 Spring and Autumn Semester
Lecturer	InternationalFaculty Faculty of Chemistry

Course Purpose

The purpose of the course is to learn about the latest international trends in the field of chemistry. Lecturers for this course are professors of chemistry invited from overseas, and they teach courses in their specialties.

Prerequisite Subjects

Depends on each lecturer of this course

Course Topics

Lecturer names, class dates, and other details will be notified in due course.

Textbook

None

Additional Reading

None

Grade Assessment

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

Notes

Depends on each lecturer of this course

Contacting Faculty

Depends on each lecturer of this course

Topics in International Chemistry 11 (1.0credits) (国際化学特論)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Starts 2	2 Spring and Autumn Semester
Lecturer	InternationalFaculty Faculty of Chemistry

Course Purpose

The purpose of the course is to learn about the latest international trends in the field of chemistry. Lecturers for this course are professors of chemistry invited from overseas, and they teach courses in their specialties.

Prerequisite Subjects

Depends on each lecturer of this course

Course Topics

Lecturer names, class dates, and other details will be notified in due course.

Textbook

None

Additional Reading

None

Grade Assessment

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

Notes

Depends on each lecturer of this course

Contacting Faculty

Depends on each lecturer of this course

Topics in International Chemistry 12 (1.0credits) (国際化学特論)

Course Type	Specialized Courses
Division at course	Doctor's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Starts 2	2 Spring and Autumn Semester
Lecturer	InternationalFaculty Faculty of Chemistry

Course Purpose

The purpose of the course is to learn about the latest international trends in the field of chemistry. Lecturers for this course are professors of chemistry invited from overseas, and they teach courses in their specialties.

Prerequisite Subjects

Depends on each lecturer of this course

Course Topics

Lecturer names, class dates, and other details will be notified in due course.

Textbook

None

Additional Reading

None

Grade Assessment

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

Notes

Depends on each lecturer of this course

Contacting Faculty

Depends on each lecturer of this course

Advanced Lectures on Scientific English (1.0credits) (科学技術英語特論)

Course Type	Comprehensive engineering courses
Division at course	Doctor's Course
Class Format	Lecture
Course Name	Graduate Chemistry
Starts 1	1 Autumn Semester
Starts 2	2 Autumn Semester
Lecturer	Part-time Faculty

Course Purpose

In this course, students will improve their ability to summarize research findings in English, submit a paper to an international academic journal, and make an English presentation at an international conference.

Prerequisite Subjects

Various subjects relating to English

Course Topics

1. Grammar for writing a scientific paper 2. How to write scientific papers 3. Public speaking for international audiences 4. Self-evaluation: writing effective CVs and job applications 5. E-mail for technical and business purposes

Textbook

Additional Reading

Ishida et al., How to Write Scientific English and Make Presentations (in Japanese), Corona Publishing Co. Ltd.

Grade Assessment

Grades will be based on assessment of presentation quality, active participation discussions, and attendance.

Notes

Contacting Faculty

Introduction to Academic Communication (1.0credits) (コミュニケーション学)

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

Course Purpose

Students will learn presentation skills for academic purposes, which may include giving academic presentations.

Japanese students are expected to present in English and international students in Japanese in the seventh or eighth class meeting.

By taking this class, students are expected to be able to do the following:

- Give a solid presentation with confidence and without hesitation
- Grasp the characteristics of successful presentations
- Use techniques learned in class in their own presentation

Prerequisite Subjects

English language classes for Japanese students

Japanese language classes for international students

Course Topics

- (1) Ways to convey messages in presentation
- (2) The language of a presentation
- (3) Tips for making effective slides
- (4) Observation and analysis of video-taped presentation by a past student
- (5) Paper vs presentation
- (6) Preparation for individual presentation
- (7) Individual presentations I

(8) Individual presentations

This course requires students to work outside of the classes for individual presentation.

Textbook

Handouts will be distributed in class

Additional Reading

1The Japan Times

2:

Grade Assessment

Individual presentation: 50%

Active class participation: 50%

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

Grading will be decided based on the ability to give an effective academic presentation.

Notes

There are no requirements for taking this class.

Contacting Faculty

Questions will be answered before class, in class, after class or by e-mail.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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

Depends on each research group of the student and the internship company

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

Depends on each research group of the student and the internship company

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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

Depends on each research group of the student

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

Depends on each research group of the student

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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

Depends on each research group of the student

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

Depends on each research group of the student

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

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

not specified.

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

Depends on each research group of the student and the internship company.

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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

Prerequisite Subjects

not specified.

Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

Textbook

not specified.

Additional Reading

not specified.

Grade Assessment

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

Notes

Depends on each research group of the student and the internship company.

Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Laboratory Visit 2 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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

No registration requirements

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

Laboratory Visit 2 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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

No registration requirements

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

Laboratory Visit 2 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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

No registration requirements

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

Laboratory Visit 2 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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

No registration requirements

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.

Laboratory Visit 2 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	Graduate Chemistry
Starts 1	1 Spring and Autumn Semester
Lecturer	Faculty of Chemistry

Course Purpose

The aim is to expand the ability as a researcher by conducting thesis research at different laboratories.

Prerequisite Subjects

None in particular

Course Topics

conducting thesis research at different laboratories

U2, U3; short term basic research, U4, U6, U8; long term advanced research

Textbook

None in particular

Additional Reading

None in particular

Grade Assessment

Credits will be awarded to those students who score 'Pass'.

Thesis supervisor will make overall evaluation based on 1) credit hours, 2) research report and 3) evaluation by the host researcher.

Notes

No registration requirements

Contacting Faculty

The questions will be answered by the direct supervisors at the mutual laboratories.