Chemistry and Biotechnology Laboratory 1 (3.0credits) (化学生命工学実験１)

Course Type	Basic Specialized Courses		
Class Format	Experiment		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

In this course, students will learn experimental operations related to the basics of analytical chemistry and physical chemistry, and deepen their knowledge of chemical reactions, chemical equilibria, thermodynamics, reaction kinetics, spectroscopy, electrochemistry, and computational chemistry. In addition, by planning and executing experiments and examining the results, and by compiling reports, students will acquire the applied and comprehensive skills required for future specialized research.

●Prerequisite Subjects

Elemental Chemistry I & II, Analytical Chemistry 1 & 2 with Exercises, Chemical Kinetics with Exercises, Thermodynamics 1 & 2 with Exercises, Structural Chemistry and Electrochemistry with Exercises, Quantum Chemistry 1 & 2 with Exercises, Safety in Laboratory

●Course Topics

After conducting the titration experiments, students will conduct individual experiments related to basic analytical and physical chemistry, organize the results of the experiments, discuss them, and write a report. Themes of individual experiments: 1. electronic spectrum, 2. vibrational spectrum, 3. separation analysis, 4. electrochemistry, 5. x-ray diffraction, 6. thermal analysis

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Other instructions will be given as needed.

●Grade Assessment

Grading will be decided based on the approach to the experiment (positiveness, activeness), logical thinking / judgment for the results, experimental skills and reports. 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 registration requirements

●Contacting Faculty

Professors and teaching assistants will answer the questions.
Contact: Jin Nakamura
Mail: nakamura[at]chembio.nagoya-u.ac.jp *Please replace [at] with @.

Chemistry and Biotechnology Laboratory 2 (3.0credits) (化学生命工学実験２)

Course Type	Basic Specialized Courses		
Class Format	Experiment		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

This laboratory class aims to learn fundamental experimental procedures on organic chemistry and biotechnology.

●Prerequisite Subjects

Elemental Chemistry I & II, Organic chemistry 1 ~ 4 with Exercises, Biochemistry 1~ 3 with Exercises, Safety in Laboratory

●Course Topics

Safety in chemical laboratory
Basic organic chemistry
1.spectroscopy in organic chemistry
2. separation and synthesis of olefin compounds and reactivity of olefinic bond
3. separation and purification of organic compounds
4. identification of unknown cimpounds
Basic Biotechnology
1. bacterial culture
2. enzyme reaction

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Vollhardt/Schore Organic Chemistry Structure and Function; K. P. C. Vollhardt, N. E. Schore
Biochemistry EIGHTH EDITION; J. M. Berg, J. L. Tymoczko, G.J. Gatto,Jr., L. Stryer

●Grade Assessment

Evaluated based on implementation of experiments and experimental reports
Credits will be awarded to those students who score 60 or more.
Grades are as follows:
A+:100-95, A:94-80, B:79-70, C:69-65, C-:64-60, F:59-0.

●Notes

No registration requirements

●Contacting Faculty

Professors and teaching assistants will answer the questions.

Mathematics I and Tutorial (4.0credits) (数学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Atsushi TAKANO Associate Professor	Jun KUMAGAI Associate Professor	ShinodaWataru Associate Professor

●Course Purpose

The course is aimed to understand the mathematics which is necessary for learning physics chemistry of special subjects. In this lecture we focus on application to chemistry rather than the rigor of mathematics. As a goal, students will develop the ability to apply mathematical methods to chemical problems.

●Prerequisite Subjects

Differential and Integral calculus III. Complex Function Theory

●Course Topics

Numbers in parentheses are chapters of a textbook1. Functions of a Single Variable: Integration (Chap.2)2. Series and Limits (Chap.3)3. Functions Defined as Integrals (Chap.4)4. Functions of Several Variables (Chap.12)5. Complex Numbers (Chap.5)6. Operators (Chap.11)7. Vectors (Chap.13)8. Coordinate Systems (Chap.14)9. Differential Equations (Chap.6)10. Power Series Solutions of Differential Equations (Chap.7)11. Orthogonal Polynomials (Chap.8)Preparing for the next lesson range by solving example questions.

●Textbook

“Mathematics for Physical Chemistry”, Donald A. McQuarrie (University Science Books) ISBN-10: 1891389564

●Additional Reading

●Grade Assessment

Exercises (20%) and Examination (80%). The minimum mark for credits is 60/100.

●Notes

No special requirement.

●Contacting Faculty

Contact addressTakano ext. 4604, e-mail atakano@chembio.nagoya-u.ac.jp Shinoda ext. 5288, e-mail w.shinoda@chembio.nagoya-u.ac.jp Kumagai ext. 2591, e-mail kumagai@imass.nagoya-u.ac.jp

Mathematics II and Tutorial (4.0credits) (数学２及び演習)

Course Type	Basic Specialized Courses	
Class Format	Lecture and Exercise	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Yukikazu Takeoka Associate Professor	Kyoichi SAWABE Lecturer

●Course Purpose

The aim of this course is to master mathematics which is necessary for in-depth learning physical chemistry of special subjects. In this lecture we focus on application to chemistry rather than the rigor of mathematics. As a goal, students will develop the ability to apply mathematical methods to chemical problems. Course topics 1 to 3 give lectures on "Mathematics used in vibration / wave motion and heat distribution in solids". Course topics 4 to 6 lecture on "fundamentals of quantum chemistry and mathematics used in computational chemistry". Course topics 7 to 9 give lectures on "mathematics used in thermal statistical mechanics and experimental data analysis”.

●Prerequisite Subjects

Mathematics I and Tutorial

●Course Topics

This lecture is composed of nine of the contents of the following. Numbers in parentheses are chapter ones of a textbook.

1. Fourier series (Chap. 9)
2. Fourier transforms (Chap. 10)
3. The classical wave equation (Chap. 15)
4. Determinants (Chap. 17)
5. Matrices (Chap. 18)
6. Matrix eigenvalues problems (Chap. 19)
7. Probability 1 Bayes' theorem
8. Probability 2 (Chap. 21)
9. Statistics: regression and correlation (Chap. 22)

Students should read the textbook or resume in the NUCT before each class. After the lecture, students should review the contents explained in tutorial time.

●Textbook

“Mathematics for Physical Chemistry”, Donald A. McQuarrie (University Science Books)
ISBN-10: 1891389564

●Additional Reading

In case of necessity, textbooks and papers are designated.

●Grade Assessment

Exercises (20%) and Examination (80%). The minimum mark for credits is 60/100.

●Notes

Earning the credit of "Mathematics 1 and Tutorial" is highly desirable, however, not required.

●Contacting Faculty

Discussion after the class or e-mail to the following address.
Suzuki ext. 2587, e-mail shushi@chembio.nagoya-u.ac.jp
Takeoka ext. 4670, e-mail ytakeoka@chembio.nagoya-u.ac.jp
Sawabe ext. 2610, e-mail sawabe@chembio.nagoya-u.ac.jp

Physical Chemistry 2 with Exercises (2.0credits) (物理化学２及び演習)

Course Type	Basic Specialized Courses	
Class Format	Lecture and Exercise	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	2 Spring Semester	
Elective/Compulsory	Compulsory	
Lecturer	Hiroyuki ASANUMA Professor	Atsushi NORO Lecturer

●Course Purpose

By learning the basics of thermodynamics, students will learn the role and importance of thermodynamics in modern science, and cultivate their creativity and comprehensiveness in addition to basic knowledge and skills.

●Prerequisite Subjects

Basic chemistry I, II; Calculus I, II; Mathematics I with Exercises

●Course Topics

Students can learn the followings according to the text book, and also several exercises. Students should submit the report of the answers of these exercises
to the lecturer.

1. Gases and the Zeroth Law of Thermodynamics
2. The First Law of Thermodynamics
3. The Second and Third Laws of Thermodynamics
4. Free Energy and Chemical Potential
5. Introduction to Chemical Equilibrium
6. Equilibria in Single-Component Systems
7. Equilibria in Multiple-Component Systems

●Textbook

Physical Chemistry by David W. Ball (Cengage Learning)

●Additional Reading

Thermodynamics by Susumu Okazaki (written in Japanese)
ISBN code: 978-4-7819-1391-9

●Grade Assessment

The evaluation of learning results will be carried out by the reports of exercises (30%) and the final examination (70%). A passing score is 60/100.

●Notes

No special requirements

●Contacting Faculty

Questions are welcome even after the lecture.
Contact address:
Hiro Asanuma052-789-2488asanuma[at]chembio.nagoya-u.ac.jp
Atsushi Noro: 052-789-4587noro[at]chembio.nagoya-u.ac.jp
(Please replace [at] with @)

Physical Chemistry 4 with Exercises (2.0credits) (物理化学４及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	Hiroyuki ASANUMA Professor	Tsukasa TORIMOTO Professor	ShinodaWataru Associate Professor

●Course Purpose

In this lecture, we will understand the basic concepts related to electrochemical reactions and thermodynamics and then understand the fundamentals of related disciplines.
Achievement targets
1. The mechanism of energy conversion can be described.
2. Explain electron conductivity and ion conductivity.
3. Understand the relationship between the reactions at electrodes and the electrode potentials.
4. Understand the basic idea of statistical thermodynamics and explain the relation between molecular theory and thermodynamic quantities.
5. Understand the concept of statistical ensemble and describe thermodynamic quantities by using the partition function.
Through these, the aim is to develop basic skills in electrochemical
reactions and thermodynamics.

●Prerequisite Subjects

Basic chemistry I, II, Physical chemistry 2 with Exercises

●Course Topics

1. Energy conversion
2. Electron conductivity and ion conductivity
3. Reactions at electrodes
4. Statistical Thermodynamics
5. Partition function and Thermodynamic Quantities
6. Statistical ensemble
Please read the designated parts of the textbook or documents before each class.

●Textbook

"Physical Chemistry, 2th Ed." D.W. Ball, Kagaku Dojin

●Additional Reading

"Physical Chemistry, 10th Ed." P. Atkins, Tokyo Kagaku Dojin

●Grade Assessment

The evaluation of learning results will be carried out by quizzes in the lecture and the final examination. A passing score is 60/100.

●Notes

No special requirements

●Contacting Faculty

Discussion after the class or with e-mail.
Contact address: torimoto@chembio.nagoya-u.ac.jp (Torimoto)
w.shinoda@chembio.nagoya-u.ac.jp (Shinoda)

Physical Chemistry 1 with Exercises (2.0credits) (物理化学１及び演習)

Course Type	Basic Specialized Courses	
Class Format	Lecture and Exercise	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	1 Spring Semester	
Elective/Compulsory	Compulsory	
Lecturer	Atsushi Satsuma Professor	Akira ODA Assistant Professor

●Course Purpose

In this lecture and exercise, students will have abundant skills to apply basic knowledge flexibly in order to contribute to the development of people who contribute to society based on their strong interest in science, with scholarship, qualities and abilities to develop engineering. The goal is to develop basic scholastic ability and basic skills in technology and research that will lead to creativity in the future. We learn the basics of chemical reaction rates: How to measure and interpret reaction rates, and understanding the theory of reaction rates based on molecular structure and thermodynamics. In addition, we will learn about the concept of energy, its relation to thermodynamics, the fundamentals of statistical thermodynamics, the energy of molecules, and the phenomena on solid surfaces as basic knowledge in understanding chemical reactions. Through this lecture, we will confirm the basic skills of the learning so far and gain a comprehensive understanding while acquiring the applied skills related to catalysts, surfaces, and batteries. In the examination, quantitative skills, logical thinking, problem solving, and thinking skills are required.

●Prerequisite Subjects

Thermodynamics, Statistical thermodynamics, Quantum chemistry, Spectroscopy

●Course Topics

1. Chemical Kinetics: Rate constant, order of reaction
2. Chemical Kinetics: Equilibrium, half-life
3. Chemical Kinetics: Temperature dependence
4. Chemical Kinetics: Elementally step
5. Kinetics of complex reactions: Reversible reaction
6. Kinetics of complex reactions: Chain reaction
7. Kinetics of complex reactions: Polymerization
8. Kinetics of complex reactions: Catalysis, Oscillation
9. Molecular reaction dynamics: Reaction and energy
10. Molecular reaction dynamics: Collision theory
11. Molecular reaction dynamics: Activated complex theory 1
12. Molecular reaction dynamics: Activated complex theory 2
13. Molecular reaction dynamics: Isotope effect
14: Surface structure of solids
15: Adsorption

Solve the exercises related to each lecture will be distributed in every week. We will discuss the answer in the lecture.

●Textbook

David W. Ball, Physical Chemistry 2nd Ed.,Cengage India Private Limited (2017).

●Additional Reading

●Grade Assessment

Examination and Report
(1) Examination 100%
(2) Examination 70%, Report 10%, Exercise presentation and discussion (20%)
A passing score is 60/100.

●Notes

No special requirement.

●Contacting Faculty

Discussion after the class or e-mail to satsuma@chembio.nagoya-u.ac.jp

Physical Chemistry 3 with Exercises (2.0credits) (物理化学３及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	ShinodaWataru Associate Professor	Kazushi FUJIMOTO Assistant Professor	Chikara OHTUKI Professor

●Course Purpose

Fundamental concepts and principles of quantum mechanics, including the basic mathematics required for understanding the quantum mechanics, will be learned through this lecture. As an introduction to quantum chemistry, the breakdown of classical physics and initial development of quantum theory will be illustrated. Using a few simple problems such as a problem of a particle in a one-dimensional box, several postulates and general principles of quantum mechanics will be learned. Further, it will be illustrated that the schrodinger equation is exactly solved for a hydrogen atom.
Course objectives: One who finish the course is expected to be able to 1. explain the fundamental concepts of quantum mechanics, 2. solve the Schrodinger equation for simple systems and understand its theoretical background, 3. explain chemical properties of hydrogen atom based on the atomic orbitals.

●Prerequisite Subjects

Mathematics 1 with Exercises, Fundamental Chemistry I, II

●Course Topics

Following to the text book, we learn Chapter 9. pre-Quantum Mechanics(Old Quantum Theory), Chapter 10. Introduction to Quantum Mechanics (Wave function and its interpretation, The Schrodinger Equation and a Particle In a Box), Chapter 11. Quantum Mechanics: Model Systems and the Hydrogen Atom.
You need to submit homework assigned after every class. You also are also required to make a report for the exercise.

●Textbook

Physical Chemistry: David W Ball (Kagaku Dojin)
Handout for supplementary explanations will be given as necessary.

●Additional Reading

Quantum Chemistry: F. Mafune (Kagaku Dojin)

●Grade Assessment

homework(15%), exercise (15%), and final exam (70 %)
The minimum mark for credits is 60/100.

●Notes

No special requirements

●Contacting Faculty

Email:
Shinoda: w.shinoda@chembio.nagoya-u.ac.jp
Fujimoto: k-fuji@chembio.nagoya-u.ac.jp
Ohtsuki: ohtsukic@chembio.nagoya-u.ac.jp

Physical Chemistry 5 with Exercises (2.0credits) (物理化学５及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	Tsukasa TORIMOTO Professor	TatsuyaKAMEYAMA Assistant Professor	Mitsuo HARA Assistant Professor

●Course Purpose

The purpose is to acquire the basic concept and physical meaning of the molecular orbital method, and to understand the molecular structure and electronic state of the molecule. In addition, you will learn about spectroscopy to study them and learn how to evaluate spectra based on quantum chemistry.
The goal of this lecture is to be able to:
1. Understand the approximate solution of the Schroedinger equation in systems with complex electronic states.
2. The molecular structure and chemical bond can be explained by the molecular orbital method.
3. Understand and explain changes in the electromagnetic spectrum due to molecular structure.
Through this lecture, students will acquire fundamental skills for understanding molecular structures by quantum chemistry, and develop a comprehensive understanding while cultivating applied skills that will link that knowledge to the interpretation of molecular spectroscopy.

●Prerequisite Subjects

Physical chemistry 3 with exercises

●Course Topics

This lecture is composed of
1. Schrodinger equation
2. Approximation methods
3 Many-electron atoms
4. Chemical bond
5. Molecular orbital
6. Molecular spectroscopy
Please read the designated parts of the textbook or documents before each class.

●Textbook

"Physical Chemistry, 2nd Ed." D.W Ball, Kagaku Dojin

●Additional Reading

"Physical Chemistry" D.A. McQuarrie and J.S. Simon (University Science Books)
"Physical Chemistry, 10th Ed." P. Atkins, Tokyo Kagaku Dojin

●Grade Assessment

The evaluation of learning results will be carried out by quizzes in the lecture and the final examination. A passing score is 60/100.

●Notes

No special requirements

●Contacting Faculty

Discussion after the class or with e-mail.
Contact address: torimoto@chembio.nagoya-u.ac.jp

Inorganic Chemistry 1 with Exercises (2.0credits) (無機化学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	1 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	NAKANISHI Kazuki Professor	Jin NAKAMURA Assistant Professor	YAMAMOTO Eisuke Assistant Professor
	KOBAYASHI Makoto Associate Professor	Shinpei KUSAKA Assistant Professor	

●Course Purpose

The purpose of this class is to improve basic skills by systematically studying inorganic chemistry, which is a basic study of chemistry, and to improve practical skills through exercises.
By learning this lecture, the goal is to be able to:
1. explain the arrangement of electrons in atoms, the periodic properties of elements, and the formation of chemical bonds from atomic orbitals.
2. understand the structure of various molecules and ionic solids formed by each element.
3. predict chemical reactions such as acid-base reactions

●Prerequisite Subjects

Fundamental chemistry I

●Course Topics

1. Atomic structure 1 Introduction: the concept of quantum numbers
2. Atomic structure 2 Atomic orbital and quantum numbers
3. Atomic structure 3 Electron configuration in atoms
4. Atomic structure 4 periodic properties of elements
5. Molecular structure and bonding 1 Lewis structure, hybridization, VSEPR theory
6. Molecular structure and bonding 2 Valence bond theory
7. Molecular structure and bonding 3 Molecular orbital theory (bonding orbital and antibonding orbital)
8. Molecular structure and bonding 4 Molecular orbital theory (di and polyatomic molecule, computational science)
9. Ionic solid 1 Close packing structure and crystal lattice
10. Ionic solid 2 Lattice energy and Born-Haber cycle
11. Acid and base 1 Leiws acid and base, HSAB theory
12. Acid and base 2 Application of acid and base chemistry

In addition to classes, exercises on each topic (Atomic structure, Molecular structure and bonding, Ionic solid, and Acid and base) (2-3 times) and the examination (1 time)will be held.
* Students should read the specified range of the textbook before every class.
* Students should solve exercise questions by the day of the exercise.
* Doing exercises at the end of each chapter is recommended.

●Textbook

Shriver and Atkins' Inorganic Chemistry, 6th edition, M. Weller, T. Overton, J. Rourke, F. Armstrong, Oxford University Press

●Additional Reading

When necessary, other textbooks will be introduced.

●Grade Assessment

The evaluation of learning results will be performed by the exam, exercises and your learning attitude.
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.

If you are absent from the final exam, your record will be "absent".

●Notes
N/A

●Contacting Faculty
We have office hours after the lecture. Besides, students can make an appointment with the lecturers via email or NUCT.

Contact address:
Kazuki Nakanishi (dknakanishi[at]imass.nagoya-u.ac.jp)
Makoto Kobayashi (mkoba[at]imass.nagoya-u.ac.jp)

Inorganic Chemistry 2 with Exercises (2.0credits) (無機化学２及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	OSADA Minoru Professor	KOBAYASHI Makoto Associate Professor	YAMAMOTO Eisuke Assistant Professor
	Ryoutarou MATSUDA Professor	Jin NAKAMURA Assistant Professor	Shinpei KUSAKA Assistant Professor

●Course Purpose

The students study fundamentals of coordination chemistry, which is one of the important disciplines in inorganic chemistry. The aim of this class is to understand such as naming methods, structure, properties and reactivity of various coordination compounds (inorganic complexes) containing transition metal elements, furthermore to crystal field theory (ligand field theory). In this class, exercises will be conducted as necessary to deepen understanding.
By receiving this lecture, you can learn the followings:
1. how to estimate complex structures from their names
2. how to understand the relationship between the complex structures and the corresponding electronic spectra
3. reaction and properties of complex

●Prerequisite Subjects

Inorganic Chemistry 1 with Exercises

●Course Topics

1. Representative ligands and nomenclature of coordination compounds
2. Constitution and geometry of coordination compounds
3. Isomerism and chirality of coordination compounds
4. Molecular Symmetry, Group theory
4. Crystal-field theory
5. Ligand-field theory
6. Electronic spectra of coordination compounds
7. Magnetic properties of transition metal complexes
8. Reaction of coordination compounds
+ Exercise and/or report (2-3 times) and examination (1 time)

Before each, the text book should be read. Doing exercises at the end of each chapter is recommended.

●Textbook

Shriver and Atkins' Inorganic Chemistry, 8th edition, M. Weller, T. Overton, J. Rourke, F. Armstrong, Oxford University Press

●Additional Reading

P. L. Gauss: Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, Wiley
When necessary, other textbooks will be introduced.

●Grade Assessment

The evaluation of learning results will be performed by the exam, exercises and report.
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.

If you are absent from the final exam, your record will be "absent".

●Notes

N/A

●Contacting Faculty

We have office hours after the lecture. Besides, students can make an appointment with the lecturers via email or NUCT.
Contact address:
Makoto Kobayashi (mkoba[at]imass.nagoya-u.ac.jp)
Ryotaro Matsuda (ryotaro.matsuda[at]chembio.nagoya-u.ac.jp)

Organic Chemistry 1 with Exercises (2.0credits) (有機化学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	1 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	MakotoYAMASHITA Professor	Yoshihiro MIYAKE Associate Professor	Yoshitaka ARAMAKI Assistant Professor
	NAKANO Ryo Assistant Professor		

●Course Purpose

Organic compounds, i.e. carbon compounds, are the largest class of compounds and they have a variety of properties, leading their important roles in every scene of social life of human being and numerous biological phenomena. In this course, you will mainly learn about the following four points: 1) structural and bonding theory about a covalent bond, which are the most fundamental concept in organic chemistry, 2) properties of a polar bond in which electrons lean toward one of two atoms constructing a covalent bond, 3) concept about "acid" and "base", and 4) a diversity of structures formed by tetrahedral (sp3) carbon atoms and stereochemistry ("configuration" and "conformation".

You will not able to understand with only attending the course. To understand the organic chemistry in this course, you should carefully read the textbook before and after the class, solve all the problem sets in textbook or provided by teachers, confirm by yourself whether you understood or not. Writing correct answer without looking the answer in the textbook means that you did understand. If you could solve problems which has slightly different compounds from those in the textbook, you should get correct answers with similar logic. Writing accurate explanation with grammatically correct sentence is also required, therefore, you should care about relationship between the subject and the verbal in your sentence. If you would lose the credit of this course, it would be very difficult to get the credit of the following organic chemistry courses. Please expend your maximum effort to get the credit of this course in the first trial.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Organic Chemistry 2 with Exercises (2.0credits) (有機化学２及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Kazuaki ISHIHARA Professor	UYANIK Muhammet Associate Professor	Yoshitaka ARAMAKI Assistant Professor
	Shuhei OHMURA Assistant Professor		

●Course Purpose

To understand fundamental concepts of organic chemistry (Chapters 7~9, 11~13)

Goal achievement
Chemistry of haloalkanes, alcohols, ethers, alkenes and alkynes

●Prerequisite Subjects

Organic Chemistry 1 and Exercises

●Course Topics

Lectures and Exercises
Chapter 7. Further reaction of haloalkanes
Chapter 8. Hydroxy functional group: alcohols
Chapter 9. Further reaction of alcohols and the chemistry of ethers
Chapter 11. Alkenes
Chapter 12. Reactions of alkenes
Chapter 13. Alkynes

Submit reports of homeworks of each lecture
preparation and review are required for each lecture

●Textbook

K. P. C. Volhardt, N. E. Schore
Organic Chemistry Structure and Function, 8th edition

●Additional Reading

●Grade Assessment

Examination (80 points) + reports (20 points)
Pass mark: 60 points

●Notes

●Contacting Faculty

Organic Chemistry 3 with Exercises (2.0credits) (有機化学３及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Hiroshi SHINOKUBO Professor	Junichi ITO Lecturer	Norihito FUKUI Assistant Professor
	NAKANO Ryo Assistant Professor		

●Course Purpose

This lecture covers topics on structures and reactivities of delocalized pi-conjugated systems including 1,3-dienes and aromatic compounds. Concepts of pi-conjugation and aromatic stabilization will be explained on the basis of a simple molecular orbital description. The mechanism and selectivity of aromatic electrophilic substitution will be discussed. The lecture also covers addition reactions of nucleophiles to aldehydes and ketones. The participants in this class will learn basic knowledge to understand the structure and reactivity of organic compounds and to design the synthetic routes to various organic compounds. In addition, the students work on the exercises to develop their creative and comprehensive thinking for understanding organic chemistry.

●Prerequisite Subjects

Organic Chemistry 1 with ExercisesOrganic Chemistry 2 with Exercises

●Course Topics

1. Dienes and the allyl system: Conjugation and delocalization 2. Reaction of conjugated dienes 3. Conjugation and aromaticity 4. Reactions of aromatic compounds 5. Electrophilic substitution of benzene derivatives 6. Polyaromatic hydrocarbons 7. Aldehydes and ketones Submit reports to be distributed after each class by next Tuesday evening.In this class, in addition to the regular class, four exercise classes will be conducted regarding on the report subject.

●Textbook

●Additional Reading

●Grade Assessment

The score will be evaluated by Assignment (50%) and Terminal Examinations (50%).

●Notes

●Contacting Faculty

You can contact the faculties in the classroom, their offices, or on-line.Shinokubo: Engg. Bld#1, room 821, ex5113, hshino(at)chembio.nagoya-u.ac.jpIto: Engg. Bld#1, room 1031, ex3336, jito(at)oec.chembio.nagoya-u.ac.jpPlease replace (at) with @.

Organic Chemistry 4 with Exercises (2.0credits) (有機化学４及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Takashi OOI Professor	Kosuke OMATSU Designated Associate Professor	Takeshi YASUI Assistant Professor
	Hironobu WATANABE Assistant Professor		

●Course Purpose

The purpose of this course is to learn features and reactivity of carbonyl compounds including aldehydes, ketones, carboxylic acids, and their derivatives. This course will also assist the student to rationally understand the mechanism of organic reactions and to develop the knowledge and appreciation of the structures, characterizations, preparations, and reactions of carbonyl compounds. In addition, the students will work on the exercises to develop their creative and comprehensive thinking.

●Prerequisite Subjects

Organic Chemistry (1-3) with Exercises.The students are recommended to have background knowledge in fundamentals of organic chemistry.

●Course Topics

1. Basics of carbonyl compounds: Students will learn how to predict the reaction mechanisms, focusing on the nucleophilic addition to carbonyl compounds.2. Enols, enolates, and aldol condensation: Learn about keto-enol tautomerism and reactions at the -position of carbonyl compounds.3. Carboxylic acids: Learn about acidity, preparations, and reactions of carboxylic acid.4. Carboxylic acid derivatives: Learn about the differences in acidity of carboxylic acid derivatives and their unique reactions.5. Ester enolates and Claisen condensation: Learn about the properties of -dicarbonyl compounds and the Claisen condensation reaction.

●Textbook

K.Peter C. Vollhardt, Neil E. Schore, Organic Chemistry: Structure and Function, 6th ed. (W.H.Freeman & Co Ltd)

●Additional Reading

HGS Molecular Model, Student Kit (Maruzen)

●Grade Assessment

The score will be evaluated by reports, usual examinations, and terminal examinations.

●Notes

●Contacting Faculty

You can contact with the faculties at the class room or their offices.Ooi: ITbM room 333, tooi@chembio.nagoya-u.ac.jpOhmatsu: ITbM room 505 south, ohmatsu@chembio.nagoya-u.ac.jp

Fundamentals of Polymer Chemistry (2.0credits) (高分子基礎化学)

Course Type	Basic Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	TakahiroSEKI Professor	Eiji YASHIMA Professor	MasamiKAMIGAITO Professor
	Atsushi TAKANO Associate Professor		

●Course Purpose

The purpose of this course is to learn basics of polymer chemistry. The course begins with basic concepts of polymer, proceeds next to polymerization and synthesis of various polymers, and moves then to characterization, structures, and properties of polymers.
Upon taking this course, you aim to learn basics of polymer chemistry, such as what polymers are, how to make polymers, how to characterize polymer properties, how properties are affected by polymer structures. You will get basic knowledge on polymer chemistry first and then abilities to apply the basic knowledge to creating new polymer materials.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Analytical Chemistry 1 with Exercises (2.0credits) (分析化学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	1 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Yoshinobu BABA Professor	Hiroshi MURAKAMI Professor	Koichi KIKUTA Professor
	Jun KUMAGAI Associate Professor	Takao YASUI Associate Professor	YUKAWAHiroshi Designated Associate Professor
	HAYASHI Gosuke Associate Professor		

●Course Purpose

The purpose of this course is to help students acquire an understanding of analytical chemistry based on the concepts of chemical reactions and chemical equilibrium. This course introduces several topics such as acid-base equilibrium, solid-liquid equilibrium, distribution equilibrium and redox equilibrium.

●Prerequisite Subjects

Chemistry in high school, Basic Chemistry I

●Course Topics

1. Physical quantity and unit
2. Chemical equilibrium in solution
3. Acid-base equilibrium
4. Acid-base titration
5. Buffering action
6. Complexation equilibrium
7. Sedimentation equilibrium
8. Redox equilibrium
9. Redox titration
10. Distribution equilibrium
11. Solvent extraction

Review and understand the contents of quizzes and exercises conducted in class.

●Textbook

T. Okada et al, "Bunsekikagaku no kiso", Kagaku Dojin (Written in Japanese)

●Additional Reading

M. Takagi"Basic Bunseki Kagaku", Kagaku Dojin (Written in Japanese)

●Grade Assessment

The weight of evaluation for the achievement target is equivalent.
Evaluate grades taking into account the final exam (80%) and the results (20%) of quizzes or exercises in class. Those who do not take the final exam will be absent.
Admission before 2019
100-90 points: S, 89-80 points: A, 79-70 points: B, 69-60 points: C, 59 points or less: F
<Admission after 2020>
100 to 95 points: A +, 94 to 80 points: A, 79 to 70 points: B, 69 to 65 points: C, 64 to 60 points: C-, 59 points or less: F

●Notes

No registration requirements

●Contacting Faculty

Questions will be accepted in the classroom after the lecture.
Otherwise, contact the instructor by e-mail beforehand.
Instructor contact:

Koichi Kikuta (ext. 3345 kik@chembio.nagoya-u.ac.jp)
Jun Kumagai (ext. 2591 kumagai@imass.nagoya-u.ac.jp)
Hiroshi Yukawa (ext. 5565 h.yukawa@nanobio.nagoya-u.ac.jp)

Analytical Chemistry 2 with Exercises (2.0credits) (分析化学２及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Yoshinobu BABA Professor	Hiroshi MURAKAMI Professor	Koichi KIKUTA Professor
	Jun KUMAGAI Associate Professor	Takao YASUI Associate Professor	YUKAWAHiroshi Designated Associate Professor
	HAYASHI Gosuke Associate Professor		

●Course Purpose

Based on the basic knowledge of analytical chemistry (classical analysis) acquired in Analytical Chemistry 1 and Exercises, students will comprehensively learn and deepen their understanding of the measurement principles, equipment configuration, setting of measurement conditions, and range of applications of instrumental analysis, focusing on various spectral analysis methods and chromatographic separation methods.

Objectives

1. To be able to understand the characteristics of various electromagnetic waves.
2. To be able to understand the measurement principles and experimental operations of spectral analysis methods using various electromagnetic waves and electron beams.
3. To be able to understand the principles and experimental operations of various separation analysis methods.
4. To be able to understand the handling of data.

●Prerequisite Subjects

Analytical Chemistry 1 and Exercises, Fundamentals of Chemistry I, Fundamentals of Chemistry II

●Course Topics

1. Introduction to instrumental analysis

This course covers the history of the development of instrumental analysis and the latest methods of instrumental analysis.

2. Various spectral analysis methods

Students will learn the basics of spectroscopic analysis, absorption spectrophotometry, fluorescence spectrophotometry, atomic absorption spectroscopy, plasma emission spectroscopy, infrared spectroscopy, and Raman spectroscopy. If there are exercises for each chapter in the textbook after the class, submit them as a small report at the next time.

3. Nuclear magnetic resonance analysis, chromatography, and electrophoresis

Students will learn the basics of each analytical method, nuclear magnetic resonance analysis, gas chromatography, liquid chromatography, and electrophoresis. If there are exercises for each chapter in the textbook after the class, submit them as a small report at the next time.

4. Exercises

Exercises on various spectral analysis methods, nuclear magnetic resonance, chromatography, and electrophoresis will be given at least one week in advance.

Students are required to submit a small report at the time of the exercise.

5. Summary and evaluation

●Textbook

Expert Applied Chemistry Text Series: Instrumental Analysis, edited by Hajime Otani, Kodansha

Other handouts will be distributed as necessary.

●Additional Reading

For electrophoresis, we recommend "Analytical Chemistry III" by Yoshio Umezawa et al, Maruzen Publishing Co.

●Grade Assessment

The weight of the evaluation is equal to the achievement goal.
The final exam (70%), quizzes or short reports (10%), and the results of exercises (20%) will be taken into account.
A score of 60 or more on a 100-point scale is considered a passing grade.
For students entering in 2020 or later
100-95 points: A+, 94-80 points: A, 79-70 points: B, 69-65 points: C, 64-60 points: C-, 59 points or lower: F
For students admitted before 2019
100-90 points: S, 89-80 points: A, 79-70 points: B, 69-60 points: C-, 59 points or lower: F

●Notes

No registration requirements

●Contacting Faculty

Questions after hours will be accepted in the classroom after the lecture.
If you have any other questions, please contact your instructor in advance by e-mail to arrange a time.
Contact information for the instructor
Yoshinobu Baba (Ext. 4664 babaymtt@chembio.nagoya-u.ac.jp)
Yutaka Murakami (Ext. 3327 murah@chembio.nagoya-u.ac.jp)
Takao Yasui (Ext. 4611 yasui@chembio.nagoya-u.ac.jp)
Hayashi, Gosuke (ext. 3328) hayashi@chembio.nagoya-u.ac.jp

Fundamentals of Chemical Engineering (2.0credits) (化学工学基礎)

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	2 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	Hiroyuki HONDA Professor	Kazunori SHIMIZU Associate Professor

●Course Purpose

The students learn the fundamentals of chemical engineering related to biotechnological production. calculation of unit and balance, the bases of flow and friction coefficient, the bases of heat and mass transfers. They learn also the unit operations and perform the excises to enhance the understandings.

●Prerequisite Subjects

There is not any background subject.

●Course Topics

1. Unit calculation 2. Material balance 3. Conduction heat transfer 4. Convection heat transfer 5. Heat exchanger 6. Bases on mass transfer 7. Diffusion 8. Mass transfer coefficient (boundary film model etc.) 9. Overall mass transfer coefficient 10. Unit operation of mass transfer

●Textbook

The third edition Kagaku Kogaku, Kaisetsu to Enshu, (Asakura Shoten)

●Additional Reading

Biochemical Engineering 2nd edition (Tokyo Kagaku Dojin)

●Grade Assessment

Examination and reports about question on the bases

●Notes

Any precondition so as to take the class is not needed.

●Contacting Faculty

Ask at classroom after lecture time. Otherwise, ask anything by e-mail. Prof. Honda (honda(at)chembio.nagoya-u.ac.jp)
*Replace "(at)" to "@" before sending e-mail.

Safety in Laboratory (2.0credits) (実験安全学)

Course Type	Basic Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

The aim of this course is to help students acquire an understanding of safety principles, handling of reactive chemicals, equipment, and counterplans against accidents, and first aid.
In this course, students are expected to be able to
1. Plan and execute safe experiments.
2. Correctly dispose of wastes generated in the course of experiments.
3. Respond appropriately to accidents and other emergencies.

●Prerequisite Subjects

All classes on chemistry and biochemistry

●Course Topics

1. Safety principles 2. Classification and handling of reactive chemicals 3. Handling of equipment and apparatus 3. Safety measures for laboratory environment 4. Earthquake countermeasures and treatment 5. Waste disposal 6. Biohazards7. Prevention and first aid 8. Experimental apparatus and equipment, and precautions for operation 9. Accidents and lessons

Students are expected to read the textbook and prepare for the class. After the lecture, review the class contents.

●Textbook

"Safety Guidelines for Chemical Experiments", 4th Edition, edited by the Chemical Society of Japan, Maruzen (1999)
"For Safe Conduct of Experiments", 8th Edition, edited by Kagaku Doujin (2017)
"To perform experiments safely -Basic operation and basic measurement-", 4th edition, edited by Kagaku Doujin (2017)

●Additional Reading

Reference books will be introduced as necessary as the lecture progresses.

●Grade Assessment

The degree of mastery of the objectives will be assessed by mid-term and final examinations.
The weight of the evaluation for the achievement target is the same, and if the students can handle the basic problems correctly, they will pass the course, and if they can handle more difficult problems, their grades will be reflected accordingly.

●Notes

No course requirements will be imposed.

●Contacting Faculty

Each lecturer will respond in class.
Please use the message function of NUCT to contact the lecturer.

Biomolecular Chemistry 1 with Exercises (2.0credits) (生命化学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	1 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	KIYONAKA Shigeki Professor	Hiroyuki HONDA Professor	Katsutoshi HORI Professor
	Hiromu KASHIDA Associate Professor	Yukiko KAMIYA Associate Professor	Kazunori SHIMIZU Associate Professor
	HajimeNAKATANI Lecturer		

●Course Purpose

This course is intended to understand basic biochemistry from a chemical point of view. This course is especially focusing on design of biomolecules including nucleic acid, protein, carbohydrates, and lipids, and basic concepts and design of metabolism system.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Biomolecular Chemistry 2 with Exercises (2.0credits) (生命化学２及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	2 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Katsutoshi HORI Professor	Atuo SUZUKI Associate Professor	HajimeNAKATANI Lecturer

●Course Purpose

Metabolism is the process by which organisms transform substances in their cells. The maintenance of the intracellular chemical environment (homeostasis) is important for an organism to survive, and metabolism is the system that maintains the chemical environment. The metabolic reactions that occur in cells are controlled by enzymes, which play a central role in metabolism by regulating reaction rates, selecting reaction pathways, and maintaining product concentrations.In this class, students will learn about metabolism, focusing on the processes by which organisms obtain energy through sugar oxidation and photosynthesis, and will acquire the ability to explain the characteristics of chemical reactions performed by organisms. The goal of this lecture is to be able to: (1) Explain the reaction rate formula, catalytic mechanism, and mechanism of activity control of enzymes (2) Explain the reason why an organism's energy acquisition reaction is efficient through sugar metabolism (3) Explain the mechanism by which organisms automatically regulate chemical reactions (4) Explain the mechanism by which plants acquire energy using sunlight and produce sugar and oxygen from carbon dioxide and water.

●Prerequisite Subjects

Biomolelular Chemistry 1 with Exercises

●Course Topics

1. enzyme　1.1 Basic concept and reaction kinetics　2.1 Catalyst mechanism　2.3 Regulation mechanism of activity 2. metabolism　2.1 Basic concept and design of metabolism　2.2 Glycolysis and gluconeogenesis 2.3 Citric acid cycle　2.4 Oxidative phosphorylation　2.5 Light reactions of photosynthesis　2.6 Calvin cycle and pentose phosphate pathway　2.7 Glycogen metabolism Please read the designated part of the textbook before each class. In addition, after the lecture, you will be required to solve the problem and submit it.

●Textbook

Biochemistry 8th edition, Jeremy M. Berg, Lubert Stryer, John Tymoczko, & Gregory Gatto, W.H. Freeman and company. (2015)

●Additional Reading

Voet's Principles of Biochemistry 5th edition, Donald Voet, Judith G. Voet, & Charlotte W. PrattJohn, Wiley and Sons, Inc. (2017)

●Grade Assessment

The achievement level in the course is evaluated by reports of the exercise (20%), an intermediate examination (40%), and a final examination (40%).If you can deal with basic issues such as explanation of concepts and terms and simple energy calculation for both of enzymes and metabolism, you will pass this course, and if you can handle the more difficult questions such as prediction and judgment by combining multiple concepts, you can get better grades accordingly.

●Notes

No course requirements.

●Contacting Faculty

We respond your questions during breaks after lectures or by email. Email address : asuzuki@chembio.nagoya-u.ac.jp

Biomolecular Chemistry 3 with Exercises (2.0credits) (生命化学３及び演習)

Course Type	Basic Specialized Courses	
Class Format	Lecture and Exercise	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Hiroyuki HONDA Professor	Kazunori SHIMIZU Associate Professor

●Course Purpose

This course is intended to understand biochemistry and molecular and cell biology from a engineering point of view. This course is especially focusing on metabolisms of lipids, nucleic acids, and amino acids, and Central Dogma including DNA replication, RNA transcription and protein translation.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Biomolecular Chemistry 4 with Exercises (2.0credits) (生命化学４及び演習)

Course Type	Basic Specialized Courses
Class Format	Lecture and Exercise
Course Name	Department of Chemistry and Biotechnology
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	KIYONAKA Shigeki Professor

●Course Purpose

In this lecture, participants are expected to obtain the ability to explain the molecular basis of several aspects in higher eukaryotes, such as regulation of gene expression, signal transduction, membrane transport system.

●Prerequisite Subjects

Biomolecular chemistry 1, 2, 3, 4

●Course Topics

1. Regulation of gene expression in eucaryotes
2. Hormones and signal transduction
3. Membrane transport system
4. Immune system
5. Neuron

●Textbook

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

●Additional Reading

●Grade Assessment

This course is evaluated by exercises, midterm exam, and final exam.

●Notes

None

●Contacting Faculty

We always accept your questions.

Chemistry and Biotechnology Exercises１ (2.0credits) (化学生命工学演習１)

Course Type	Specialized Courses		
Class Format	Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	4 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

In the tutorial lessons, we will perform the reading and discussions on the reference books (English) in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. We will feed 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

Textbooks and papers will be suggested in each research group: 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 Materials Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, EcoNano 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

Students will be suggested some references.

●Grade Assessment

Depends on research groups. In general, oral examinations and/or reports for the basic knowledge on each research field.

●Notes

●Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry and Biotechnology Exercises２ (2.0credits) (化学生命工学演習２)

Course Type	Specialized Courses		
Class Format	Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	4 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

In the tutorial lessons, we will perform the reading and discussions on the reference books (English) in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. We will feed 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

Textbooks and papers will be suggested in each research group: 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 Materials Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, EcoNano 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

Students will be suggested some references.

●Grade Assessment

Depends on research groups. In general, oral examinations and/or reports for the basic knowledge on each research field.

●Notes

●Contacting Faculty

Ask to the corresponding Professors in each research group.

Chemistry and Biotechnology Laboratory 3 (3.0credits) (化学生命工学実験３)

Course Type	Specialized Courses		
Class Format	Experiment		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

This course enhances the development of the student's skill in carrying out organic chemistry and biotechnology experiment. It will help your graduation research in 4th grade (graduation thesis A and B).
In organic chemistry laboratory, you will learn advanced experimental protocols for the synthesis, separation, purification, and identification of organic molecules.
Biotechnology laboratory aims to learn advanced experimental procedures.

●Prerequisite Subjects

Elemental Chemistry I & II, Organic chemistry 1 ~ 5 with Exercises, Biochemistry 1~ 4 with Exercises, Chemistry and Biotechnology Laboratory 2, Safety in Laboratory

●Course Topics

* Advanced organic chemistry
1-a. Asymmetric synthesis of phenylalanine using chiral phase transfer catalysts
1-b. Derivatization of citronellal
2-a. Cross-coupling reaction with Grignard reagents
2-b. Chemiluminescence with luminol
3. C-C bond formation with enolate anions
4. Lidocaine as a synthetic drug
5. Synthesis of benzene ring via [2+2+2] cycloisomerization of alkynes with ruthenium catalyst

* Advanced biotechnology
1. XXX 2. XXX

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Vollhardt/Schore Organic Chemistry Structure and Function; K. P. C. Vollhardt, N. E. Schore
Biochemistry EIGHTH EDITION; J. M. Berg, J. L. Tymoczko, G.J. Gatto,Jr., L. Stryer

●Grade Assessment

Evaluated by implementation of experiments and experimental reports

Credits will be awarded to those students who score 60 or more.
Grades are as follows:
A+:100-95, A:94-80, B:79-70, C:69-65, C-:64-60, F:59-0.

●Notes

No registration requirements

●Contacting Faculty

Professors and teaching assistants will answer the questions.

Chemistry and Biotechnology Laboratory 4 (3.0credits) (化学生命工学実験４)

Course Type	Specialized Courses		
Class Format	Experiment		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

In order to cultivate academic skills, qualities, and abilities to develop engineering, it is necessary to acquire various advanced experimental knowledge and operations. The aim of this experiment is to acquire advanced experimental knowledge and operations related to inorganic chemistry, physical chemistry, polymer synthesis chemistry, and polymer physical chemistry. It also enhances the development of the ability to organize and analyze data and create reports.

This experiment consists of two parts; Inorganic/Physical Chemistry Experiment and Polymer Chemistry Experiment. By the end of this experiment, students should be able to do the following:

<Inorganic and physical chemistry experiment>
1. Acquiring basic knowledge on firing process, structural analysis and physical property evaluation of ceramics.
2. Understanding the fabrication process of nanosheets based on solution chemistry and the analysis method of nanomaterials.
3. Acquiring basic knowledge of inorganic and complex chemistry and learning characterization techniques relating to complex.
4. Acquiring basic knowledge of inorganic and analytical chemistry through the synthesis and evaluation of hierarchical porous materials.
5. Acquiring basic knowledges to make an experimental plan, to interpret the results, and to explain the achievements through reports and oral presentations.
6. Understanding the electron energy structure of semiconductors/organic dyes and their photoresponsivity.
7. Understanding the basics of programming on Linux OS through computer experiments on proteins.

< Polymer chemistry experiment>
1. Acquire an understanding of synthesis, separation/purification, and characterization of polymer.
2. Acquire an understanding of the safety experimental operation
3. Acquire knowledge regarding preparation of polymer materials and evaluation method of polymer physical phenomena.
4. Design experimental plans, organize and analyze data, and discuss results.
5. Create a logical report.
6. Deepen the understanding of polymer synthesis chemistry and polymer physical chemistry.

●Prerequisite Subjects

Chemistry and Biotechnology Laboratory 1 ~ 3, Safety in Laboratory, Elemental Chemistry I & II, Chemical Kinetics with Exercises, Thermodynamics 1 & 2 with Exercises, Structural Chemistry and Electrochemistry with Exercises, Quantum Chemistry 1 & 2 with Exercised, Inorganic Chemistry 1 & 2 with Exercises, Chemistry of Inorganic Reaction, Organic Chemistry 1 ~ 5 with Exercises, Fundamentals of Polymer Chemistry, Synthetic Polymer Chemistry

●Course Topics

Advanced experiments on inorganic chemistry, physical chemistry, and polymer chemistry, are carried out, then results of the experiments are discussed and summarized in a report. Presentation is also carried out in inorganic and physical chemistry experiment. Individual experimental topics are as follows.

<Inorganic and physical chemistry experiment>
1. Synthesis and analysis of biomedical ceramics
2. Synthesis and characterization of inorganic nanosheets
3. Syntheses of porous metal complexes, characterization of porous metal complexes
4. Synthesis and characterization of hierarchically porous materials by sol-gel method
5. Catalytic action in hydrogen peroxide decomposition reaction
6. Fabrication and characterization of dye-sensitized solar cell
7. Protein computer experiment guidelines.

<Polymer chemistry experiment>
1. Preparation and Characterization of Thermoplastic Elastomers Correlation between the Long-Chain Molecular Structure and the Physical Properties
2. Radical Copolymerization, Living Radical Polymerization, and Interfacial Polycondensation As Representatives of Chain-Growth Polymerization, Living Polymerization, and Step-Growth Polymerization
3. Contact Angle Goniometry for Surface Tension Measurements of Solid Surfaces Zisman Plot and Surface Treatment Techniques
4. Synthesis of Luminescent Poly(p-phenylenevinylene)-Amylose Composites

Read the experimental guideline before each experiment. In addition, a report task is assigned for each experiment. After organizing, analyzing, and considering the experimental results, submit it as a report by the submission deadline.

●Textbook
Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading
Other instructions will be given as needed.

●Grade Assessment
Grading will be decided based on the approach to the experiment (positiveness, activeness), logical thinking / judgment for the results, experimental skills and reports. Credits will be awarded to those students who score 60 or more out of 100 points. By passing both experiments of Inorganic/Physical Chemistry Experiment and Polymer Chemistry Experiment, you can earn the credits for this experiment.

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
There are no requirements.

●Contacting Faculty
Professors and teaching assistants will answer the questions.

Elements of Chemistry and Biotechnology (2.0credits) (化学生命工学序論)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	1 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

The lecture is an introduction to chemical and biological engineering, such as Molecular Chemistry, Macromolecular Chemistry, Applied Physical Chemistry, Solid State Chemistry, Biomolecular chemistry, and Biosystem Engineering.Students will aquire the basic knowledge of chemistry and also understand the role of researchers and engineers in chemical and biochemical industries.

●Prerequisite Subjects

Chemistry learned in your high school

●Course Topics

Introduction to chemical and biological engineering. Basic knowledge of applied chemistry, material chemistry and biomolecular engineering are learned, and their topics are shown.1. Molecular and macromolecular chemistry 2. Material chemistry 3. Biomolecular engineering

●Textbook

Not identified

●Additional Reading

Suggested by each lecturer

●Grade Assessment

Reports

●Notes

No registration requirements

●Contacting Faculty

Do not hesitate to ask any questions during the class.

Inorganic Chemistry 3 (2.0credits) (無機化学３)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Ryoutarou MATSUDA Professor	OSADA Minoru Professor	Joji HASEGAWA Designated Associate Professor

●Course Purpose

The goal of this class is as follows:
Learn the basics of the crystalline structures, amorphous structures, and lattice defects of inorganic solids, acquire basic scholarship on the correlation between structures and physical properties, learn the phase equilibrium and chemical reactions of solids, and understand the basics and applications of inorganic material processing.

By learning this lecture, the goal is to be able to explain:
1. Representative crystal structures
2. Relationship between crystal structure and physical properties
3. Phase equilibrium of solids, Synthesis of inorganic solids
4. Basic of materials processing and its applications

●Prerequisite Subjects

Fundamental Chemistry I
Fundamental Chemistry II
Inorganic Chemistry 1 with Exercises
Inorganic Chemistry 2 with Exercises

●Course Topics

1. Basic of crystal structure
2. Crystal structure and physical properties
3. Defect chemistry
4. Crystal and amorphous structures
5. Stability and phase relations in inorganic solids
6. Reactions of inorganic solids
7. Diffusion and sintering
8. Reactions for structure control

●Textbook

Solid State Chemistry and its Applications (Anthony R. West, Wiley)

●Additional Reading

1. Shriver and Atkins' Inorganic Chemistry, 6th edition, (M. Weller, T. Overton, J. Rourke, F. Armstrong, Oxford University Press ; 2014)

2. Fundamentals of Solid State Chemistry and Inorganic Materials, Ed. (G. Adachi, Maruzen; 1995)(in Japanese)

3. SOLID STATE CHEMISTRY : AN INTRODUCTION, Second edition (Smart & Moore, Chapmann & Hall)

4. "Ceramic Materials - Science and Engineering"(Carter & NortonSpringer)

5. Introduction of Materials Phase Diagram, (H.Saka, Asakura Books)(in Japanese)

●Grade Assessment

The level of achievement to the goal will be evaluated in reports, midterm exams, and final exams.
Pass if you understand the basics of crystalline and amorphous solids, and reflect your grades accordingly if you have acquired more advanced knowledge and acquired the academic ability to use it.

●Notes

Nothing

●Contacting Faculty

Questions after the lecture will be accepted in the lecture room.
Questions at other times will be accepted by email.

Professor Ryotaro Matsuda (Tel: 4603, email: ryotaro.matsuda@chembio.nagoya-u.ac.jp)

Professor Joji Hasegawa (Tel: 5859, email: h-george@imass.nagoya-u.ac.jp)

Professor Minoru Osada (Tel: 2750, email: mosada@imass.nagoya-u.ac.jp)

Inorganic Chemistry 4 (2.0credits) (無機化学４)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	3 Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Chikara OHTUKI Professor	OSADA Minoru Professor

●Course Purpose

The purpose of this course is to understand basic concept of the functions of inorganic materials (ceramics) from a chemical viewpoint, and to learnfrom bird's eyes view on application of their functions based on their understanding, in order to acquire the ability to create new materials and their applications that support a sustainable society.

Goal of this course
1. to acquire fundamental knowledge of synthesis, structure and functions of inorganic materials
2. to understand the content of research papers on state-of-the-art inorganic materials
3. to acquire the ability to estimate the value and future outlook of inorganic materials.

●Prerequisite Subjects

Inorganic Chemistry 1 with Exercises,
Inorganic Chemistry 2 with Exercises,
Inorganic Chemistry 3,
Chemistry of Inorganic Reaction

●Course Topics

Lectures on the following contents related to inorganic materials will be given.

1. Properties and chemical compositions of inorganic materials
2. Microstructure of inorganic solids
3. Characterization of inorganic materials
4. Electrical properties and their applications
5. Magnetic properties and their applications
6. Optical properties and their applications
7. Thermal properties and mechanical properties
8. Structural materials and composite materials
9. Functional materials
10. Summary and evaluation

In each lesson, read the designated part of the relevant textbook. Use the exercises and reference books shown in the lecture for review.

●Textbook

Solid State Chemistry and its Applications, Second Edition: Anthony R. West, Wily (2014)

●Additional Reading

Fundamentals of Solid State Chemistry and Inorganic Materials, Ed. by G. Adachi, Maruzen (1995)(in Japanese)
Inorganic Functional Materials, Ed. by K. Koumoto, Tokyo Kagaudojin (2009)(in Japanese)
Elementary Ceramic Science, N. Soga, Agune Shohusya (1993)(in Japanese)

Other references will be introduced during the class as necessary.

●Grade Assessment

Students should understand important contents correctly about the synthesis, structure and function of inorganic materials. The evaluation is performed by interim and regular examinations. Credits will be awarded to those students who score 60 or more out of 100.

●Notes

There are no requirements to take the class.

●Contacting Faculty

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

Contact information:
Professor Chikara Ohtsuki (ohtsuki@chembio.nagoya-u.ac.jp)
Professor Minoru Osada (mosada@imass.nagoya-u.ac.jp)

Structural Organic Chemistry (2.0credits) (有機構造化学)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	3 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	YoshihikoYAMAMOTO Professor	Mineto UCHIYAMA Lecturer

●Course Purpose

The primary purpose of this lecture is to teach the chemistry student how to identify organic compounds from the complementary information afforded by spectra such as MS, IR, NMR, and UV. Some selected topics of structural organic chemistry is also given.

●Prerequisite Subjects

Organic Chemistry I - V

●Course Topics

1. Introduction 2. Ultraviolet Spectrometry 3. Mass Spectrometry 4. Infrared Spectrometry 5. 1H and 13C NMR Spectrometry 6. Exercise for Determination of Organic Structure

●Textbook

L. M. Harwood, T. D. W. Claridge; Introduction to Organic Spectroscopy

●Additional Reading

Spectroscopic Methods in Organic Chemistry; M.Hesse,H.M.Meier,B.Zeeh (THIEME) Spectrometric Identification of Organic Compounds; Silverstein and Webster (Weiley)

●Grade Assessment

Cumulative scores ofExercises, Reports, and Final Examination.

●Notes

N/A

●Contacting Faculty

Tel 6800, E-mail yamamoto-yoshi@ps.nagoya-u.ac.jp
Tel 3187, E-mail uchiyama@chembio.nagoya-u.ac.jp

Organic Chemistry 5 (2.0credits) (有機化学５)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	3 Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Tomoyuki IKAI Associate Professor	Masatoshi SIBUYA Lecturer

●Course Purpose

In this class, we shall learn amines, chemistry of benzene substituents, heterocycles, carbohydrates, amino acids, peptides, and nucleic acids as the final stage of fundamental organic chemistry in the undergraduate program. The chemistry already learned in Organic Chemistry 1-4 will also be reviewed.

●Prerequisite Subjects

Organic Chemistry 1-4

●Course Topics

1, Review of Organic Chemistry 1-42-4, Amines and Their Derivatives5–7, Chemistry of Benzene Substituents8, 9, Carbohydrates10, 11, Heterocycles12–14, Amino Acids, Peptides, Proteins and Nucleic Acids15, Summary and evaluation

●Textbook

Vollhardt/Schore Organic Chemistry Structure and Function Sixth Edition

●Additional Reading

●Grade Assessment

Your overall grade in the class will be decided based on the following:Cumulative scores of Reports (20%) and Examination (80%).

●Notes

●Contacting Faculty

During a break after lecture.

Physical Chemistry 6 (2.0credits) (物理化学６)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	TakahiroSEKI Professor	ShinodaWataru Associate Professor	Tsukasa TORIMOTO Professor
	Atsushi Satsuma Professor		

●Course Purpose

In this lecture, we will develop application skills that flexibly apply basic knowledge in order to contribute to fostering people who contribute to society based on strong interest in science, with academic skills and qualities and abilities to open up engineering, The goal is to develop basic academic skills and skills for research that will lead to future creativity. We understand the basic concepts of photochemistry, theoretical chemistry, catalyst and surface chemistry, electrochemistry, and nanomaterial synthesis from the physicochemical aspect, and understand the fundamentals of related disciplines.
Achievement target
1. The mechanism of applying light energy can be described.
2. Explain the mechanism of the photochemical reaction.
3. Understand the basic concepts of statistical mechanics.
4. Understand the electronic structure of molecules and the fundamentals of computational chemistry and theoretical chemistry of complex molecular collective systems.
5. Understand the mechanism of catalytic reaction and evaluation of surface (catalyst and adsorption / reaction, use of X-ray, IR, UV-Vis, magnetic resonance)
6. Understand various catalysts (metal catalysts, homogeneous catalysts, photocatalysts, acid-base catalysts, oxidation catalysts) and their use (petroleum / petrochemical industry and catalysts, environment / energy-related catalysts)
7. Understand basics of electrochemistry and photoelectrochemistry
8. Understand synthesis methods and functions of nanomaterials (metal and semiconductor nanoparticles).
Through these, the aim is to develop basic and applied skills in photochemistry, theoretical chemistry, catalyst and surface chemistry, nanomaterials and related physical chemistry.

●Prerequisite Subjects

Basic Physical Chemistry, Reaction Kinetics, Quantum Chemistry, Basic Inorganic Chemistry, Basic Organic Chemistry

●Course Topics

[Photochemistry] 1. Adsorption and emission of light by organic molecule. 2. Feature and mechanism of photochemical reaction. 3. Photochemical reaction and material chemistry. [Theoretical chemistry] 4. basics of statistical thermodynamics. 5. Molecular dynamics simulation. 6. Quantum chemical calculation. [Catalysis and surface] 7. Basic principles of catalysis and Characterization of catalysts. (Catalysts, adsorption and reaction; and Application of X-ray, IR, UV and magnetic resonance) 8. Various catalysts (Metal catalysts, Homogeneous catalysts, Photocatalysts, Acid-base catalysts, and selective oxidation catalysts) 9. Application of catalysis (Oilrefinery and catalysts, Catalysts for petrochemical, Catalysts for environment and energy) [Surface and electrochemistry] 10. Basic principles of electrochemistry and photoelectrochemistry. 11. Design of nano-materials (Preparation of metal and semiconductor nanoparticles and their structure control) 12. Applications of nano-materials (Electrocatalysts, Photocatalysts, Fuel cells, and Solar cells)
Please read the designated part of the textbook or documents before each class.

●Textbook

Handouts are provided.

●Additional Reading

●Grade Assessment

Examination and reports.
A passing score is 60/100.

●Notes

No special requirement.

●Contacting Faculty

Discussion after the class or e-mail to
tseki@chembio.nagoya-u.ac.jp (Seki)
w.shinoda@chembio.nagoya-u.ac.jp (Shinoda)
torimoto@chembio.nagoya-u.ac.jp (Torimoto)
satsuma@chembio.nagoya-u.ac.jp (Satsuma)

Analytical Chemistry 3 (2.0credits) (分析化学３)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	Yoshinobu BABA Professor	Hiroshi MURAKAMI Professor	Koichi KIKUTA Professor
	Jun KUMAGAI Associate Professor	Takao YASUI Associate Professor	YUKAWAHiroshi Designated Associate Professor
	HAYASHI Gosuke Associate Professor		

●Course Purpose

The aim of this course is to gain an understanding of basic principles as well as the applications in instrumental chemistry.

●Prerequisite Subjects

Basic Chemistry II, Basic Chemistry II, Analytical Chemistry 1 and Exercise, Analytical Chemistry 2 and Exercise

●Course Topics

1. Microscope
Learn the principles and applications of optical and electron microscopies.
2. Mass spectrometry
Learn about the principles of ionization, mass spectrometry, and detection units and their applications for mass spectrometry.
3. Electron spin resonance method
Learn about analytical methods using unpaired electrons.
4. Material analysis
Learn the principles and applications of methods for analyzing materials, such as X-ray crystal structure analysis, surface analysis, and thermal analysis.
5. Biochemical analysis
Learn the principles and applications of commonly used biochemical analyzes such as immunoassays and bioimaging.
6. Latest chemical analysis
Learn the principles and applications of the latest biochemical analysis such as microanalysis and next-generation sequencers.
Review the relevant sections of the textbook after each class.

●Textbook

H. Otani, "Kikibunseki", Kodansha

●Additional Reading

Use the following references as needed.
Yoshio Umezawa et al., Analytical Chemistry III, Maruzen Publishing

●Grade Assessment

Able to properly explain analytical chemistry methods related to instrumental analysis as a supporting technology for advanced analytical chemistry and biochemical research. The ability to explain practical application examples to chemical research is a criterion for acceptance.
Evaluate grades by taking into account the final exam (80%) and quizzes or small reports (20%).
Admission before FY2019
100-90 points: S, 89-80 points: A, 79-70 points: B, 69-60 points: C, 59 points or less: F

<Admission after 2020>
100 to 95 points: A +, 94 to 80 points: A, 79 to 70 points: B, 69 to 65 points: C, 64 to 60 points: C-, 59 points or less: F

●Notes

No registration requirements

●Contacting Faculty

Students can communicate with their course instructor after their classes or appointment times. Please make an appointment by email.
Yoshinobu Baba (ext.4664babaymtt@chembio.nagoya-u.ac.jp)
Hiroshi Murakami (ext.3327murah@chembio.nagoya-u.ac.jp)
Koichi Kikuta (ext.3345kik@chembio.nagoya-u.ac.jp)
Jun Kumagai (ext.2591kumagai@imass.nagoya-u.ac.jp)
Hiroshi Yukawa(ext.5654h.yukawa@nanobio.nagoya-u.ac.jp)
Takao Yasui (ext.4611yasui@chembio.nagoya-u.ac.jp)
Gosuke Hayashi (ext.3328 hayashi@chembio.nagoya-u.ac.jp)

Synthetic Polymer Chemistry (2.0credits) (高分子合成化学)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	
Starts 1	3 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	Eiji YASHIMA Professor	MasamiKAMIGAITO Professor

●Course Purpose

The purpose of this course is to learn basics of polymer synthesis. The course begins with basic concepts of polymer, proceeds next to step-growth polymerization, and moves then to chain-growth polymerization and polymer reaction.

Upon taking this course, you aim to learn basics of polymer synthesis, such as what polymers are, how to make polymers by step- and chain-growth polymerizations, how to synthesized well-defined polymers, how to functionalize polymers by polymer reaction. You will get basic knowledge on polymer synthesis first and then abilities to apply the basic knowledge to creating new polymer materials.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Physical Chemistry of Macromolecules (2.0credits) (高分子物理化学)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	Atsushi TAKANO Associate Professor	Atsushi NORO Lecturer	Part-time Faculty

●Course Purpose

The purpose of this course is to learn basic physical properties of polymer solutions and solids in terms of molecular characteristics of polymer chains.

●Prerequisite Subjects

Fundamentals of Polymer Chemistry, Elements of Physical Chemistry, Thermodynamics with Exercises, Structural Chemistry and Electrochemistry with Exercises

●Course Topics

1.Introduction for this course
2.Statistical properties of polymer chain
3.Thermodynamics of polymer solution
4.Light scattering
5.Viscometry, SEC and the other method for determiniation of molecular weight of polymers
6.Semi-dilute and concentrated solution
7.Phase behavior of polymer solution
8.Basic property of molten amorphous polymer (homopolymers)
9.Basic property of molten amorphous polymer (polymer blends and block copolymers)
10.Structure of cristalline polymers
11.Thermal properties of polymers
12.Basics of viscoelastic properties of polymers
13.Viscoelastic behavior of polymers
14.Rubber elasticity
15.Molecular theory of viscoelasticity of polymers

●Textbook

Syunsuke Murahashi, Tadao Kodaka, Mikiharu Kamachi, Naosi Norisuye “Kobunshikagaku ”5th Edition (kyoritsu) written in Japanese,
and appropriate references will be given in the lecture.

●Additional Reading

P.J.Flory, "Principles of Polymer Chemistry" (Cornell University Press, New York, 1953)
P.G.deGenne, "Scaling concepts in Polymer Physics" (Cornell University Press, New York, 1979)
Yushu Matsushita, "Kohunshi no Kozo To Bussei" (Kodansha)

●Grade Assessment

Short exercise in class (20%) and Examination (80%)
More than 60% is required for credits.

●Notes

●Contacting Faculty

Discussion after the class or with e-mail.
Contact address
Takano: atakano@chembio.nagoya-u.ac.jp
Noro: noro@chembio.nagoya-u.ac.jp

Bioreaction Engineering (2.0credits) (生物反応工学)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Katsutoshi HORI Professor	Atuo SUZUKI Associate Professor	HajimeNAKATANI Lecturer

●Course Purpose

Students should understand properties of biocatalysts, such as microorganisms and enzymes, and stoichiometry and kinetics of biochemical reactions using biocatalysts. Students should also understand the constitution of bioprocesses and learn the mechanisms and structures of bioreactors for their design.

●Prerequisite Subjects

Chemical Kinetics with ExercisesBiochemistry 1 with ExercisesBiochemistry 2 with ExercisesBiochemistry 3 with ExercisesBiochemistry 4 with ExercisesFundamentals of Chemical Engineering

●Course Topics

1. Biological reaction engineering: molecular system
2. Basis of Microbiology
3. State of the art of molecular biology (DNA sequencing, genome edition)
4. Metabolism of cells and Stoichiometry of cell growth
5. Kinetics of enzymatic reaction and bioreactor
6. Kinetics of Microbial reaction
7. Cultivation process
8. Biological wastewater treatment
9 Aeration and agitation
10. Bioseparation

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

After the class or arrangement on E-mail.

Biological data science and engineering (2.0credits) (生物情報工学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Chemistry and Biotechnology
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Ryuji KATO Associate Professor

●Course Purpose

In recent life science researches, explosive quantity of "data" is being produced by the advances of measurement instruments and assay systems.
The research styles in life sciences that had been struggling with the exploration of single gene-related mechanisms had been drastically changed to explore the systematic mechanism of whole expression profiles. As a result, biologists now have to process massive amount of data to further interpret the biology.
In chemistry, it is also a trend to handle massive database of molecular structures to interpret or design the reactions by computer assisted approaches. Therefore, the active usage of data analysis is now a key skill to design efficient experiments.
However, in common, biologists and chemists are not amused by computer assisted data analysis. Therefore, as a fact, in many researches, the precious and live data obtained by biologists and chemists are passed to the information professionals before "understanding the data". This is almost throwing out the inspirations and clues obtained through the experiment, and frequently cause trouble in understanding the complex analysis results.
Therefore, to further lead the next generation life sciences, researchers are strongly required to understand, interpret, and connect their own data with their original inspirations and ideas. Especially for researchers with engineering background, the "original aspect of engineering mind" that makes them differ from other faculty professionals is important to play their professional role.
This lecture aims to support students whose background is biology/chemistry (outside of information science) to learn the basics of data science to analysis and interpret the life science related data by engineering minded aspect.
(Note: This lecture is not designed to teach programming language or skills. This is the lecture to understand the importance of data science in life science, and educate the basic sense for further skill up by own effort. Therefore, this lecture focus on discussion and debate, and spare more time for thinking about the data).

●Prerequisite Subjects

Life science related subjects: Molecular Biology, Bioengineering, Biochemistry, Analytical chemistry, etc.

●Course Topics

This lecture is designed for students whose background in biology/chemistry (outside the information science) and will be presented with simple and basic language and illustration to learn the basics of data science.

The lecture is designed to learn the requirements for data science in society, issues in the technology which creates data, and the actual data science basics (data preparation and analysis) as basics for data science.

This lecture requires three times of "report and discussion" day, to collect the knowledge from the lecture and bridge it to deeper understanding.

The detailed lecture schedule will be announced on the first day of lecture.

Introduction

Data scicence basics Requirements for data science)
Data science basics (Data and information)
Technologies for life science data1Conventional)
Technologies for life science data2 (Advanced)
Technologies for life science data3 (Advanced)
Making data1 (Experimental design)
Making data2 (Experimental design)
Making data3Noise and Bias control)
Analysis (Statistical approach)
Analysis (Machine learning approach)

Three times of report submissions are required for the lecture.
By commenting and discussion on the report, the lecture aims to
connect the knowledge to understanding.

●Textbook

Support materials/prints will be handed as necessary.

●Additional Reading

Related books are only in Japanese.
For further assistance, contact the lecturer.

●Grade Assessment

Students are evaluated totally by "report 50%", "Q&A discussion 50%". Score 60 in total score 100 is required to pass the lecture. Students are required to attend the lecture with questions. Students who skipped the lecture more than 3 times are regarded as "absent". Students can decline the lecture registration. For further detail, contact the lecturer.

●Notes

Basically, the lecture is held on web (Zoom) in realtime. However, considering the social circumstances, direct lectures in the classroom can be a choice. Therefore, please carefully confirm the schedule at the introduction, and also at the NUCT announcements.

●Contacting Faculty

Questions are welcome by email to the lecturer, however, it is not promised for immediate response.
Email : kato-r@ps.nagoya-u.ac.jp

Selected Topics on Chemistry and Biotechnology (2.0credits) (化学生命工学特別講義)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

The aim of this lecture is to obtain broad and basic knowledge relating to chemistry and biochemistry.

Students will be able to
1) Learn novel research field in chemistry and biochemistry.
2) Understand current status of chemical and biochemical industries.
3) Acquire creativity and comprehensive abilities.

●Prerequisite Subjects

Undergraduate specialized classes

●Course Topics

The lecture will be given by the experts in the various research fields relating to chemistry and biochemistry.

●Textbook

References will be given in each lecture.

●Additional Reading

References will be given in each lecture.

●Grade Assessment

Examination or reports

●Notes

No registration requirements

●Contacting Faculty

Ask to each lecturer in the class.

Graduation Thesis A (5.0credits) (卒業研究A)

Course Type	Specialized Courses		
Class Format	Experiment and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	4 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.

Achievement target
1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.
2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Prerequisite Subjects

Undergraduate specialized classes

●Course Topics

●Textbook

Will be designated by the supervisor in each group.

●Additional Reading

Refer to the necessary books and papers according to your research theme.

●Grade Assessment

Grading will be decided based on research approach, discussion in group, and achievement of graduation thesis.

●Notes

No registration requirements

●Contacting Faculty

Ask to the supervisors in each group.

Graduation Thesis B (5.0credits) (卒業研究Ｂ)

Course Type	Specialized Courses		
Class Format	Experiment and Exercise		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	4 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.Achievement target1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Prerequisite Subjects

Undergraduate specialized classes

●Course Topics

●Textbook

Will be designated by the supervisor in each group.

●Additional Reading

Refer to the necessary books and papers according to your research theme.

●Grade Assessment

Grading will be decided based on research approach, discussion in group, and achievement of graduation thesis.

●Notes

No registration requirements

●Contacting Faculty

Ask to the supervisors in each group.

General Electrical Engineering 1 (2.0credits) (電気工学通論第１)

Course Type	Related Specialized Courses
Class Format	Lecture
Course Name	Department of Chemistry and Biotechnology
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Akimori TABATA Associate Professor

●Course Purpose

This course deals with fundamental of electrical circuit theory which is one of the most important subjects of electrical engineering.

The goals of this course:
(1) to understand and explain the properties of electrical elements.
(2) to understand and explain circuit equations.
(3) to understand and explain steady-state and transient phenomena of electrical circuit.

●Prerequisite Subjects

Mathematics 1 with Exercises, Electromagnetics

●Course Topics

1. Circuit elements
2. Sinusoidal alternating current and electric power
3. Complex impedance and phasor
4. Circuit equations
5. Circuit Network theorem
6. Resonance circuits
7. Mutual induction circuits
8. Transient phenomena

●Textbook

●Additional Reading

●Grade Assessment

Examination. You must score 60% or more to pass the course.

●Notes

No requirement for the course.

●Contacting Faculty

Contact by e-mail (tabatanuee.nagoya-u.ac.jp)

General Electrical Engineering 2 (2.0credits) (電気工学通論第２)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering
Starts 1	4 Autumn Semester	3 Autumn Semester
Elective/Compulsory	Elective	Elective
Lecturer	TomokazuFUKUTSUKA Professor	

●Course Purpose
The aim of this course is to help students acquire the fundamental of secondary batteries such as lithium-ion batteries. At the end of the course, participants are expected to understand the electrochemistry for secondary batteries.

●Prerequisite Subjects
Fundamentals of Chemistry I, II

●Course Topics
1. Electrolysis cell, electrochemical system
2. Electrolyte solution
3. Electromotive force and electrode potential
4. Structure of electrode/electrolyte interface
5. Electrode reaction: charge-transfer process
6. Electrode reaction: diffusion process
7. Corrosion

●Textbook
Printed materials will be provided as needed.

●Additional Reading

●Grade Assessment
Your overall grade in the class will be decided based on the examination. Basic questions about the electrochemistry should be answered to pass.

●Notes
No course requirements.

●Contacting Faculty
Contact by email.

Patent and Intellectual Property (1.0credits) (特許及び知的財産)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Energy Science and Engineering
	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering	Civil Engineering
	Architecture		
Starts 1	2 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester		
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective		
Lecturer	Masahiro KITO Professor		

●Course Purpose

Understand the necessity and significance of patents from the viewpoint of researchers and engineers at universities and companies

Acquire basic knowledge of patents and acquire what researchers and engineers who invent should do.

Attainment target

1. Understand the purpose and necessity of the patent system
2. Understand the basics of patent application procedures and how to write application documents
3. Can perform basic patent search
4. Understand how companies and universities use patents

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

No requirement for the course.

●Contacting Faculty

Management Engineering (2.0credits) (経営工学)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering
	Department of Mechanical and Aerospace Engineering	Architecture	
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

[purpose of the class] In the corporate management, I learn it about the management of the technique that is essential for the growth, development and the innovation.
[arrival target] I become able to understand a way of thinking and the basics of management. I understand an organization change and an organization design, the management of the innovation and come to be able to give explanation.

●Prerequisite Subjects

●Course Topics

Management of technology (MOT) and knowledge management
Management and artefact (artifact)
Organization to realize innovation
Science, technique, sense of values
Innovation and organization learning

[instructions of the class overtime learning]
Preparing a next class range, and understanding the meanings of the technical term.

●Textbook

Isao Naito, Yukihiro Wakuta edition (2016) " organization theory of the representation" CHUOKEIZAI-SHA

●Additional Reading

Instructions will be given as necessary in class

●Grade Assessment

[evaluation method] I give a small test to look back on the lecture content of the day before the end of the lecture of every time and have you finally submit a report. I evaluate it at 50% of normal points, report point 50%. In addition, I do not accept the submission of the report when there is absence more than 1/3.
[point of reference] Pass in understanding the basic concept and term in conjunction with the management engineering definitely; is based.

●Notes

There are no prerequisites.

●Contacting Faculty

I accept questions during the class.

Industry and Economy (2.0credits) (産業と経済)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering
	Department of Mechanical and Aerospace Engineering	Civil Engineering	Architecture
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
Lecturer	Part-time Faculty		

●Course Purpose

I learn knowledge about the economy while examining the background, structure, influence about various economic phenomena, pocketbook issues.
I learn the economic thought method that economists built that understanding, explanation solves a pocketbook issue at the same time.

A target: In this lecture, a student attending a lecture aims for coming to be able to do the next thing.
1. As a member of society, an industrial person, I learn necessary and useful economic knowledge and come to be able to inflect.
2. I understand structure and the mechanism of the economic phenomenon, pocketbook issue and come to be thought systematically.
3. I understand the way of economic thought (view, way of thinking) and learn it and become able to inflect.

●Prerequisite Subjects

Because it is not a specialized subject, I do not appoint it in particular.

●Course Topics

1. Economic circulatory structure ... give-and-take
2. Change ... prosperous conditions and recession of the economy
3. Foreign exchange rate ... strong yen and weak yen
4. Role ... annual revenue and annual expenditure of the government
5. Maintenance of role ... price stability and the trust order of Bank of Japan
6. Problem ... overflow of population of the population and too few population
7. Economic history ... Smith and Keynes
8. Free-market economy ... light and shadow
9. Japanese economy ... inflation and deflation after World War II

Reading as I appoint the range that should read a textbook beforehand at the time of a lecture of every time for the next time.
In addition, reviewing it as I show a part to review and a method about the document which I distributed, and deepening understanding.

●Textbook

Nakaya"Nyumonsho wo yomumae no Keizaigaku nyumon",Doubunkan

●Additional Reading

P. A.Samuelson, W. D.Node house "economics" (Iwanami Shoten) Kennichi Miyazawa () "introduction to industrial linkage analysis" (Nikkei library, Nihon Keizai Shimbun, Inc.) Iwao Ozaki "industrial structure of Japan" (Keio University publication society)

R. A.I introduce it at the time of a lecture of every time including Feldman "economic latest lecture of the Dr. Feldman in Japan" (Bungeishunju Ltd.).

●Grade Assessment

Understand a basic concept about the economy definitely, and keep the structure of the pocketbook issue under control, and, in wearing an economic thought method, pass; is based. I evaluate an accomplishment degree by a small report (20%) to assign at the time of a lecture of every time and the regular examination (80%) of the term end and do higher than 60 points with a pass at one hundred perfect score. In addition, the absentee of the regular examination assumes it "absence".

●Notes

There are no prerequisites.

●Contacting Faculty

Around during the lecture and lecture time, a charge teacher copes in a lecture room

Technical Visits in Industrial Plants (1.0credits) (工場見学)

Course Type	Related Specialized Courses		
Class Format	Practice		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	4 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

In this course, students will visit several chemical factories and plants to understand the current manufacturing process.The students will understand how the knowledge in the lectures can be applied for the chemical plants.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

No registration requirements

●Contacting Faculty

Training in Industrial Plants (1.0credits) (工場実習)

Course Type	Related Specialized Courses		
Class Format	Practice		
Course Name	Department of Chemistry and Biotechnology		
Starts 1	3 Spring Semester		
Elective/Compulsory	Elective		
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

The aim of this course is to help students acquire basic knowledge of chemical and biochemical industries through practical training in the companies. Students will be able to understand the manufacturing process in real factories based on the knowledge they have learned at the university.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Outline of Engineering 1 (1.0credits) (工学概論第１)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
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	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

Based upon the wide and deep experiences, alumini and/or aluminae of Nagoya University, who work the hub of society,give future perspectives, foster internal and external active personality and propose guideline for their further study.

●Prerequisite Subjects

Because it is a common subject not to affect a specialized subject, I do not appoint the subject to become the background.

●Course Topics

Experience every time own as "do your best younger student" a senior playing an active part in the social center I perform a class on the basis of this. In all eight times of classes, I perform orientation and the lecture by seven outside lecturers. What I check about a lecturer and a title released before a class of every time beforehand. After a lecture, conduct an additional investigation depending on the need including contents and the phrase handled in a lecture. In addition, submit it as you impose the report problem about lecture contents every time.

●Textbook

I distribute a slide or the print which the person in charge of each time lecturer uses as a lecture document.

●Additional Reading

Instructions will be given as necessary in class

●Grade Assessment

I evaluate an acquirement degree for the accomplishment by a report. I keep lecture contents of every time under control, and it is said that I pass if I can collect own thought and lets results reflect it according to the depth of the contents which were able to learn it such as the grasp of lecture contents, a guideline for the future dream, study of oneself.

●Notes

●Contacting Faculty

I cope after a lecture every time. Or ask the staff of the educational affairs section.E-mail:t-nagasaki@energy.nagoya-u.ac.jp

Outline of Engineering 2 (1.0credits) (工学概論第２)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

It is recognized as an urgent issue to create low-carbon society in order to mitigate global warming. The objective of this lecture is to understand the current situation of Japan in terms of energy supply and demand as well as technologies of energy conservation and renewable energy utilization. Energy policy of Japan such as Energy Basic Plan is also one of the topics.
It is expected that the lecture provides fundamental understanding of measures to deal with reducing primary energy consumption.

●Prerequisite Subjects

Fundamentals of Engineering

●Course Topics

1. Situation of Japan with respect to energy
2. Energy policy and Energy Basic Plan
3. Solar energy technologies
4. Energy conservation technologies with wasted heat recovory
5. Social systems for low-carbon society
6. Try "Test of Energy"

●Textbook

None.

●Additional Reading

To be distributed in the lecture.
"Test of Energy", http://www.ene-kentei.jp

●Grade Assessment

Reports are required to be submitted during the lecture. The subjects are presented in the lecture.

●Notes

There are no prerequisites.

●Contacting Faculty

All questions are encouraged to be presented during the lecture.

Outline of Engineering 3 (2.0credits) (工学概論第３)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Emanuel LELEITO Lecturer	GRIB Dina Lecturer	Gang ZENG Lecturer
	Kiyohisa NISHIYAMA Designated Lecturer		

●Course Purpose

This course will introduce the history, the current state and future prospects of R&D (research and development) in various sectors related to the field of engineering in Japan. The course will expose you to a wide range of issues being tackled by engineers in different fields, with the aim of motivating and preparing you to pursue your research interest. You will have an opportunity to explore basic concepts and real-world applications, and to do a mini research tasks leading to a final presentation.

Apart from the engineering field related knowledge, this lecture will also help you develop the following skills:
Cross-disciplinary communication skills
Communication across language barriers (English/Japanese)
Online search and research skills for information gathering
Presentation skills

●Prerequisite Subjects

You do not require any background knowledge to join this class. Each lecturer will provide the basic knowledge that might be needed to understand the lecture topics.

●Course Topics

This class consists of “omnibus-style” lectures on the following topics.

1. Science, Technology and Innovations in Embedded Computing Systems (Gang ZENG)
- This lecture gives an overview of the embedded computing systems related technologies in Japan. In particular, the latest innovations on the low-energy and automotive applications will be introduced.
- The students are asked to participate in group discussion to share their ideas and thoughts about energy conservation and future automobiles.

2. The innovative factors of technologies in Japan (Kiyohisa NISHIYAMA)
- This lecture provides the participants with the concept of 40 innovation principles. Some Japanese technologies are broken down into the combination of the principles as examples.
- The students each are asked to analyse a technology of interest found in Japan. The students will be able to grab the concepts of any technological innovations after completing this lecture.

3. Science, Technology and Innovation for Disaster Risk Reduction (Emanuel LELEITO)
- This lecture gives students an overview of the Scientific and Technology Innovations that have contributed to Japan's leading role in Disaster Risk Reduction (DRR).
- DRR related discussions and presentation in class will help students exercise their creative thinking and problem solving skills.

4. Societal, Cultural and Economic Contexts of Engineering Practice in Japan (Dina GRIB)
- The last part of this course introduces you to the Science, Technology and Society studies (STS) field and provides a brief overview of how Japanese cultural, economic, societal and political tradition affects technological innovation and scientific research as well as how STI in turn affect Japanese culture, society and politics.
- The participants will be invited to conduct a mini case study using online materials, share their findings in class and participate in group discussions.

●Textbook
Lecture materials will be distributed in class during each lecture.

●Additional Reading
References and materials for additional reading will be introduced in class during each lecture.

●Grade Assessment
Credits will be awarded to those students who score over 60 out of 100 based on the following evaluation criteria:

1) Reports (60%): Each lecturer will ask you to prepare and submit reports to valuate your understanding of the topics taught. The reports will be worth 60% of the total score.
2) Presentation (40%): You will be asked to do a final presentation based on one or a combination of the topics taught. The presentation will require that you to do independent online research to gather necessary information and present the topic in 3-5 minutes. Your understanding of the topic as well as the effectiveness of your presentation will be evaluated. The presentation is worth 40% of the total score.

●Notes
None

●Contacting Faculty
Questions are received during or after class time. Lecturers will provide contact information during class orientation.

Outline of Engineering 4 (3.0credits) (工学概論第４)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
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	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

Elementary ClassThis course is intended to teach Japanese to students who have not learnt Japanese before or who have learned only a very little. Basic Japanese which is necessary for daily life in Japan will be taught.
The students study the fundamentals of grammar and basic conversational expressions. The students are requested to communicate in daily life using simple expressions.
Intermediate ClassThis course is intended to teach Japanese to students who already learned Japanese of Elementary level. The aims of this study are to obtain the ability necessary to explain their experiences concretely.
The students are requested to communicate in their study in Japanese. Depending on the students' Japanese ability, the advanced class will also be prepared.

●Prerequisite Subjects

Elementary ClassNone
Intermediate ClassElementary Japanese

●Course Topics

Elementary Class1.Pronunciation of Japanese 2.Structure of Japanese sentences 3.Fundamental vocabulary and expressions 4.Conversation practice 5.Listening practice, Students must read the part which they will study in the next lecture.
Intermediate Class1 Grammar, 2 Conversation, 3 Opinion delivery, 4 Reading comprehension, 5 Listening practice, The students must momorize the most important sentences which they will study in the next lecture.

●Textbook

Elementary ClassNIHONGO Breakthrough, From suruival to communication in Japanese, JAL Academy, ASK Publishing Co.Ltd.

Intermediate Classweekly J ： 6

●Additional Reading

I introduce it to progress appropriately

●Grade Assessment

Elementary ClassClass performance 20Assignments 20Interview test and examination30, Presentation 30
In each item, the ability of comversation is an important check point.
Intermediate ClassClass performance 20Assignments 10Interview test 20Written examination20, Presentation 30.

In each item, the ability of correct expressions is an important check point.
These scores are summed and evaluated. The students with the evaluation S, A, B, or C can pass this subject.

●Notes

This subject is open for NUSIP students.

●Contacting Faculty

Ext. 6797 ishida@nuem.nagoya-u.ac.jp

Engineering Ethics (2.0credits) (工学倫理)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
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	
Elective/Compulsory	Elective	Elective	Elective
	Compulsory	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

All students will push forward the preparations to a member of society through a college life having high flexibility as well as the lecture of the university, but this is the conscious problem that it is independent and should work on. Therefore, about life, the responsibility of the necessary member of society (a person of occupation and researcher solving another person such as engineers and social problem situation), found ability, ethic, it is the purpose of the class that gets an image at the beginning of student life. I solved many problems until now, and the engineer developed the society, but had much failure, accidents and the ethical disgraceful affair. I understand basic power to act as a member of society, an engineer ethically while having the viewpoint to the future a little while referring to a lot of such failure examples. In addition, I acquire a custom to think on the spot, and to be settled necessary for an engineer, a member of society. (the lecturer is engaged in a study and the business of the engineer ethic in professional engineer (nation qualification) with the work experience.)

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

There are no prerequisites.

●Contacting Faculty

E-mail:roofrate3-nug@yahoo.co.jp