共生応用化学セミナー　Introductory Seminar for Applied Chemistry and Biotechnology
[Instructor] Faculty members
[Credits] 2
[Semester] 1st year-Spring-Tues 4
[Course code]T1M001001
[Room] Bldg. ENG-1-audiovisual room (3F), Bldg. ENG-2-102, Bldg. ENG-5-104, Bldg. ENG-5-105, Bldg. ENG-5-204, each lab office
[Course enrollment] All students of 1st year of Department of Applied Chemistry and Biotechnology
[Candidate] Students of Department of Applied Chemistry and Biotechnology must take this course.
[Course objectives] The technology developed rapidly in the 20th century, which gave many benefits to mankind and has advanced the well-being of mankind; however, it is required to utilize the global environment effectively while preserving the environment, and contribute to the true well-being of mankind in the 21st century.　For that purpose, it is important to develop a chemical process in harmony with the environment, and create new material adjusted to the environment, as well as learn from organisms in order to advance these.　Organisms interact with various external stimuli (information) and respond based on information accumulated during several generations.　To develop materials or processes which excels or substitutes these by extracting these functions from organisms, and putting them to chemically practical use is an important direction for mankind in order to harmonize with the environment and co-exist with other organisms.　Based on these viewpoints, the purpose is to experience the latest chemistry in each laboratory, as well as for students to learn what is necessary for developing new chemicals and chemical processes.　In addition, the purpose of the training is to recognize the modern problem on its own initiative and find out the scientific solution, as well as for students to learn how to discuss and present through the lecture and making out the career portfolio.　Through the above, student will be able to sort out and utilize various information, as well as have discussions based on that. Moreover, students will be able to adopt new knowledge actively.
[Plans and Contents] “Introductory Seminar for Applied Chemistry and Biotechnology” is a seminar to motivate, “What do students learn in the Department of Applied Chemistry and Biotechnology”.　Guidance is carried out at the first seminar, and a small grouping of approximately 10 people is made. From the second time on, students are going to participate in lectures and experimentation in relation to research subject implemented in each laboratory.　In parallel with that, students are going to participate in group discussion through making out the career portfolio that is to raise a problem and search for its solution on their own.
1. Guidance
2. From the second time on, students are going to participate in lecture and make out the career portfolio (problem presentation, discussion, and presentation on a per-group basis) and theme learning (assignment in each laboratory).　In the case of theme learning, students will need to study and understand the contents and related fields that will be conducted in each laboratory in advance.
[Evaluation] This depends on efforts of group discussion through making out the career portfolio, as well as evaluation points of each laboratory with regards to theme learning. Results of examination of English learning (listening and reading) are also reflected.
[Remarks] Attendance will be emphasized.　If absences are frequent (more than 1/5), the student may not be able to receive credits.

無機化学 I　Inorganic Chemistry I
[Instructor] Yasuhiko Iwadate
[Credits] 2
[Semester] 1st year-Fall-Thurs 2
[Course code] T1M100001
[Room] Bldg. ENG-2-201, Bldg. ENG-5-204 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] About 60
[Candidate] Specially Registered Non-Degree Student may take this course.and students of Department of Applied Chemistry and Biotechnology must take this course. (For those whose Student ID NO. is even).
[Course description] The basic matter of inorganic chemistry from structural theory to chemical bond of the hydrogen atom as an introduction of inorganic chemistry is going to be explained, and then each theory in relation to acid-base and compound is going to be lectured.
[Course objectives] After students understand the structure of atoms constituting material and stability of atomic nucleus, students are going to deepen their understanding of the periodicity of an element, size of atoms and ions, as well as chemical bonds.　Students are going to learn general properties of elements based on this, expand their knowledge in relation to each property of S-block and compounds which consist using this element group, as well as learn the basic idea for understanding those in a systematic manner.
[Plans and Contents] To evaluate learning achievements while proceeding to the lecture in accordance with the textbook, making efforts for easy to understand explanation by using OA equipment as necessary, as well as comprehending students' understanding level and planning its improvement by assigning unit tests and term-end examination.　Preparation and review of handouts will be imposed for learning outside of class.

1. Introduction and periodic table
2. Atomic spectrum of hydrogen
3. Bohr theory on atomic structure
4. Orbital energy level
5. Wave equation and orbital shape
6. Pauli exclusion principle and Hund's rule
7. Alkali metal and alkali earth metal
8. Types of chemical bondms
9. Ionic bond (ionization potential, ionic radius, potential between ions)
10. Covalent bond (molecular shape, hybrid orbital, electronegativity, dipole moment, molecular orbital method, resonance)
11. Metallic bond
12. Hydrogen bond
13. Coordination bond (complex ion and complex, chelate compound)
14. Concept of acid-base
15. Oxide, peroxide, superoxide, hydride
16. Summary, end-of-term exam

[Keywords] Hydrogen atom, Bohr theory on atomic structure, orbital, energy level, wave equation, Pauli exclusion principle, Hund's rule, nucleus, periodicity of element, atomic and ionic sizes, chemical bond forms, acid-base
[Textbooks and Reference Books] Textbook：Kisomukikagaku(by Y. Sasaki et al.)Asakura-shoten, Reference Books：Kisomukikagaku(by J.D.Lee, translated by H. Hamaguchi)Tokyokagakudoujin ; Mukikagaku(by D.F.Shriver, P.W.Atkins, translated by R. Tamamushi et al.)Tokyokagakudoujin.
[Evaluation] Evaluation is comprehensively given by the score of unit test (40%) and the end-of-term exam (40%) coupled with reports (20%). In the case of cheating in the exams, the relevant students will be punished in accordance with the school rules. The deadline of the reports is one week before the end-of-term exam.
[Related courses] Basic Chemistry A
[Course requirements] Students must have taken Basic Chemistry A.
[Remarks] Compulsory courses of Department of Applied Chemistry and Biotechnology. Office hour：Fall, Monday 17:40- at Bldg. ENG-1-217. (Student must take an appointment by email)

無機化学 I　Inorganic Chemistry I
[Instructor]　Nobuyuki Ichikuni
[Credits] 2
[Semester] 1st year-Fall-Thurs 2
[Course code] T1M100002
[Room]: Bldg. ENG-5-104
[Candidate] Specially Registered Non-Degree Student may take this course.and students of Applied Chemistry and Biotechnology must take this course. (For those whose Student ID NO. is odd.)
[Course description] The basic matter of inorganic chemistry from structural theory of the hydrogen atom to chemical bond as an introduction of inorganic chemistry is going to be explained, and then concept of acids/bases and compounds is going to be lectured.
[Course objectives] After students understand the structure of atoms and stability of atomic nucleus, students are going to deepen their understanding of the periodicity of elements, size of atoms and ions, as well as chemical bonds.　Students are going to learn general property of elements based on this, expand their knowledge in relation to each property of S-block and a compound which is consisted by this element group, as well as learn the basic idea for understanding those in a systematic manner.　Targeted Goal: (1) To be able to describe the structure of atoms and atomic nucleus. (2) To be able to explain the periodicity of elements. (3) To be able to explain the chemical bonds systematically.
[Plans and Contents] To evaluate learning situations by conducting short tests within each lecture, and comprehending students' understanding level.　To indicate items which lack students' understanding and development contents in the next lecture, so students are required to review and address improvement of their understanding level. To evaluate the overall learning achievement by a midterm examination and term-end examination.

1. Preface, atomic spectrum of hydrogen, Bohr's theory of atomic structure: Preparatory reading of Textbook Ch. 1.
2. Orbital energy level: Preparatory understanding of unit system
3. Wave equation and orbital form: Revise contents taught during the lectures
4. Pauli exclusion principle and Hund's rule, periodic law of elements: Prepare a summary on the periodic table
5. Chemical bond (type of bonds): Preparatory reading of Textbook 6.1
6. Chemical bond (Ionic bond 1): Revise items highlighted during the 5th lecture
7. Chemical bond (Ionic bond 2, covalent bond 1): Revise items highlighted during the 6th lecture
8. Chemical bond (Covalent bond 2): Revise items highlighted during the 7th lecture
9. Concept of acids/bases: Understanding the concept of pH
10. Alkali metal: Revise items highlighted during the 9th lecture
11. Oxide: Revise items highlighted during the 10th lecture
12. Peroxide, superoxide: Revise items highlighted during the 11th lecture
13. Hydride: Revise items highlighted during the 12th lecture: Revise items highlighted during the 12th lecture
14. Alkali earth metal: Revise items highlighted during the 13th lecture
15. End-of-term examination
16. Overall commentary: Learn about the items taught at the end of the 15th lecture

[Keywords] Hydrogen atom, Bohr's theory of atomic structure, orbital, energy level, wave equation, Pauli exclusion principle, Hund's rule, atomic nucleus, periodicity of elements, atomic radius and ionic radius, chemical bonds, acids and bases
[Textbooks and Reference Books] Textbook: Y. Sasaki et al.: Basic Inorganic Chemistry (Japanese) (Asakura Publishing Co., Ltd.),　Reference books: J. D. Lee: CONCISE INORGANIC CHEMISTRY; D. F. Schriver et al.: Shriver and Atkins INORGANIC CHEMISTRY, 4th ed.
[Evaluation]　Evaluation is given by the midterm examination (30%), end-of-term examination (60%),　and short tests/reports.(10%). As a general rule, students who have not taken the midterm examination cannot take the end-of-term examination.
[Related courses] "Fundamental Chemistry A".
[Course requirements] Students must have taken "Fundamental Chemistry A".
[Remarks] Compulsory course of Department of Applied Chemistry and Biotechnology.

有機化学 I　Organic Chemistry I
[Instructor] Takashi Karatsu
[Credits] 2
[Semester] 1st year-Fall-Wed 2
[Course code] T1M101101
[Room] Bldg. ENG-15-110
[Course enrollment] about 100
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] Lectures for training knowledge, understanding, and ability to think which are the fundamentals of organic chemistry are going to be conducted. Understandings of organic molecules (structure, property, and nomenclature), foundation of basic reaction, are going to be explained. As for organic chemistry I-V, the essence of organic chemistry is going to be learned in accordance with the textbook: "Organic Chemistry: Structure and Function (Part 1 and 2) by Vollhardt & Schore".
[Course objectives] Not only acquisition of knowledge, the purpose is to understand the basic principles and fundamental rule of various phenomena and reactions with regards to organic chemistry. Students are mainly going to learn the basics of bonding and structure, chain and cyclic compound, and stereo isomer (geometric and optical isomers) of organic molecules. In addition, students are going to learn acidity-basicity, nucleophilicity, leaving ability, solvent effect, and reaction coordinate, etc. with regards to nucleophilic substitution reaction and elimination reaction based on property and reaction of alkane and haloalkane, as well as to acquire important items for understanding organic reactions. Also, the targeted goals are to be able to name substances by using the contents acquired, and explain its structure and reaction mechanism, etc.
[Plans and Contents] As for organic chemistry I, the range of the textbook of Vollhardt & Schore from chapters 1 to 7 will be used for lecture. This lies next to the basic chemistry in organic chemistry and this is the only compulsory subject in organic chemistry I ~ IV. The basic ability of organic chemistry is going to be trained here. A combination of PowerPoint and writing on a blackboard are going to be used, and the material used in PowerPoint will be printed out and distributed. Exercises will be conducted every time in order to confirm students' understanding level and attendance. Students are required to bring A4 sized paper. Students will need to review at least 15 minutes after each lecture. In addition, students won't leave their question and will ask me.

1. Guidance: How to study organic chemistry, how to proceed with the lessons
2. Structure and bond of organic molecules 1
3. Structure and bond of organic molecules 2
4. Structure and reactivity 1
5. Structure and reactivity 2
6. Reactions of alkane 1
7. Reactions of alkane 2
8. Cycloalkane
9. Interim exam
10. Explanation of interim exam, stereoisomer 1
11. Stereoisomer 2
12. Properties and reactions of haloalkane 1
13. Properties and reactions of haloalkane 2
14. Reactions of haloalkane, and lesson survey
15. End-of-term exam
16. Explanation of end-of-term exam, outlook towards future lecture subjects (organic chemistry II)

[Keywords] Organic Chemistry, Alkane, optical isomerism, nucleophilic substitution, reaction mechanism
[Textbooks and Reference Books] "Organic Chemistry, the sixth edition (Part 1)" by Vollhardt & Schore from Kagakudojin will be used as a new textbook. Organic chemistry (part 1) by Jones that was used until the last year can be used provisionally as well. Although they are expensive, part 1 and 2 textbooks are going to be used for lecture of "Organic Chemistry I ~ IV" and "Advanced Organic Chemistry" in our graduate school as well.
[Evaluation] It will be evaluated by considering attendance and report (20%) and two examinations (midterm and end-of-term). The reports should be submitted by the end of each lecture. The attendance points will be evaluated by not just attendance or absence. It includes the contents of the reports submitted. The additional examination may be conducted for only students who meet attendance regulations. It is forbidden to take unauthorized materials such as textbooks and any notes/documents into exams.
[Related courses] Basic Chemistry B、Organic chemistry II、Organic chemistry III、Organic chemistry IV

[Course requirements] Preferably students should have a good understand chemistry in high school and have studied Basic Chemistry B. Students who studied other departments or subjects of study need to notify the instructor at the first lecture. [Remarks] Moderate exercises will be conducted during the lectures. This also helps to check attendances. Video viewings, simple demonstration experiments, and manufacturing molecular model will be conducted. Reports may be imposed as overtime learning. "To Read Textbook Well" will be emphasized in this year as well. Student can ask questions at any time, but must take an appointment by email in advance.

物理化学 I　Physical Chemistry I
[Instructor] Nobuyuki Ichikuni
[Credits] 2
[Semester] 2nd year-Spring-Fri 1
[Course code] T1M102001
[Room] Bldg-ENG-5-204
[Candidate] Specially Registered Non-Degree Student may take this course. And students of Department of Applied Chemistry and Biotechnology must take this course.
[Course description] The lecture is focused on the way of thinking for basic theory in physical chemistry.　Specifically, the theory of chemical equilibrium and thermodynamics for micro physical chemistry will be the center of explanation.　To confirm students understanding level by conducting short test moderately.
[Course objectives] Students will learn how to describe internal energy, Gibbs function, real gas, and chemical potential, etc. by combining the first law of thermodynamics and the second law.　Targeted Goal: (1) Students will understand what kind of impact the pressure and temperature will give to chemical equilibrium.　(2) Students will understand the relation between the state change and thermodynamic function such as physical modification of a mixture.
[Plans and Contents] To evaluate learning situations by conducting short tests within each lecture, and comprehending students' understanding level.　To indicate items which lack students' understanding and development contents in the next lecture, so students are required to review and address improvement of understanding level.　Evaluation of the overall learning achievement is conducted by imposing the midterm and term-end examinations.

1. Preface, real gas: Preparatory understanding of physical quantity and SI units system
2. Second law of thermodynamics: Preparatory understanding of first law of thermodynamics
3. Combination of first and second laws of thermodynamics: Revision of items highlighted during the 2nd lecture
4. Gibbs function and Helmholtz function: Revision of expanded contents taught during the lectures
5. Gibbs energy properties: Revision of expanded contents taught during the lectures
6. Chemical potential and fugacity: Revision of expanded contents taught during the lectures
7. Phase equilibrium (1): Revision of items highlighted during the 6th lecture
8. Phase equilibrium (2): Revision of items highlighted during the 7th lecture
9. Phase rule: Revision of expanded contents taught during the lecture
10. Solutions and partial molar quantity: Revision of expanded contents taught during the lectures
11. Thermodynamics of the mixture (1: Comparison with gases): Revision of items highlighted during the 10th lecture
12. Thermodynamics of the mixture (2: Raoult's Law and Henry's Law): Revision of items highlighted during the 11th lecture
13. Ideal solution and real solution: Revision of items highlighted during the 12th lecture
14. Colligative properties: Revision of items highlighted during the 13th lecture
15. End-of-term examination
16. Overall commentary: Revision of items pointed out at the end of the 15th lecture

[Keywords] Enthalpy, Entropy, Gibbs energy, Chemical equilibrium, Phase equilibrium
[Textbooks and Reference Books] Textbook：Peter Atkins and Julio de Paula: PHYSICAL CHEMISTRY, 8th ed., Reference book：Raymond Chang: PHYSICAL CHEMISTRY, for the Chemical and Biological Sciences
[Evaluation] Evaluation is given by the midterm examination (30%), end-of-term examination (60%), and short tests/reports (10%).　As a general rule, students who have not taken the midterm examination cannot take the end-of-term examination.
[Related courses] Physics DI: Introduction to Thermodynamics and Statistical Mechanics，Recitation Course for Thermodynamics
[Course requirements] Students must have taken "Fundamental Chemistry A" and "Physics DI: Introduction to Thermodynamics and Statistical Mechanics".

生体分子の化学 Biomolecular Chemistry
[Instructor] Keiki Kishikawa
[Credits] 2
[Semester] 2nd year-Spring-Thurs 1
[Course code] T1M103001
[Room] Bldg. ENG-15-109, Bldg. ENG-15-110, Bldg. ENG-17-113
[Candidate] Students of faculty of Engineering. And Students of the Department of Applied Chemistry and Biotechnology must take this course.
[Course description] To explain the structure and property of organic compounds (sugars, lipids, amino acids, peptides) which support the life phenomenon, as well as reactions of those.
[Course objectives] Purpose:
Students will learn the structure and property regarding the basic element that constructs organism, and be able to understand that the biological activities have been consisted by organic chemical reaction of those elements. Targeted Goal: Students will be able to distinguish the structural features of sugars, lipids, amino acids, and peptides, etc. In addition, students will be able to explain the relation between structures and functions of those elements.
[Plans and Contents] The class will be conducted along with the contents of the textbook. Please prepare before the class and review the important parts that I mention in the class on your own. The class will be conducted in the order of monosaccharide → polysaccharide → lipid → amino acid → peptide, and tests to check the understanding level will be performed in the middle and the end during 15 classes. Handouts are going to be given out to students in every class. Students will need to submit it with important phrases or questions. We would like to incorporate the latest news which is not in the textbook.

1. Stereochemistry of biomolecules
2. Monosaccharide (1)
3. Monosaccharide (2)
4. Polysaccharide (1)
5. Polysaccharide (2)
6. Classification and structure of lipids (1)
7. Classification and structure of lipids (2)
8. Overall revision of the first half and comprehension test
9. Lipid aggregates and biological membrane (1)
10. Lipid aggregates and biological membrane (2)
11. Amino acid (1)
12. Amino acid (2)
13. Peptide (1)
14. Peptide (2)
15. Overall revision of the second half and comprehension test

[Keywords] Biomolecule, Organic Chemistry, Reaction Mechanics, Sugar, Lipid, Amino Acid, Peptide
[Textbooks and Reference Books]”Chemistry of Biomolecules” Saburo Aimoto and Kenichi Akaji; Kagaku-Dojin, price: ¥2,000.
[Evaluation] Evaluated by considering 70% of the tests of understanding level in the first and second half, and 30% of the attendance points. Unless there is any special reason, more than four-fifths attendances will be the prerequisite for earning credits. Being late for the class will be subject to deduction. As for the test for understanding level, the questions based on the targeted goal will be given. Specifically, they will be the areas covered from “Important Topics” in the textbook, handouts, and the material written on the blackboard during the class. However, it includes practical exercises that utilize knowledge obtained from the Lecture as well. (Note that cheating on tests will be handled strictly.)
[Remarks] No specific requirements (knowledge, skill) for registration.

無機化学 II　Inorganic Chemistry II
[Instructor] Naofumi Uekawa
[Credits] 2
[Semester] 2nd year-Spring-Wed 2
[Course code] T1M104001
[Room] Bldg. ENG-2-103
[Course enrollment] 100
[Candidate] Students of faculty of Engineering
[Course description] Based on knowledge learned from “Inorganic Chemistry I”, necessary knowledge for inorganic chemistry will be systematically taught in order to deepen students’ understanding of inorganic material, environment, and organism. In addition, the lecture will be performed while considering promoting the understanding for the modern topic that is related to inorganic chemistry.
[Course objectives] This lecture is offered so that students will be able to examine inorganic compound and inorganic reaction with relation to knowledge of other chemistry field with open view. Specifically, the purpose is to learn the following knowledge with the basis of quantum theory, understanding of atoms and molecules learned from “Inorganic Chemistry I” as well as knowledge regarding chemistry for typical elements. (1) Learn about transition metal elements that have complex electronic states and its compounds. (2) Synthesis reaction of inorganic compounds and its mechanism. (3) Understanding of electric and optical properties of inorganic compounds as well as its expression mechanism. (4) The application of environment of knowledge of inorganic chemistry and understanding the organism.
[Plans and Contents]
1. What is inorganic chemistry? : Revision and overview of this course
2. Electron configuration of atoms – Correct understanding based on quantum theory – Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
3. Electronic configuration of molecules – Focus on developmental examples- Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
4. Chemistry of transition metal element (d electron) (1): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
5. Chemistry of transition metal element (d electron) (2): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
6. Developmental understanding of the concept of acid-base and oxidation-reduction for the purpose of understanding inorganic substances: Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
7. Reactions of inorganic compounds in a solution (1): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
8. Reactions of inorganic compounds in a solution (2): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
9. Reactions of inorganic compounds in a solid or gaseous phase: Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
10. Properties of inorganic compounds (1): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
11. Properties of inorganic compounds (2): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
12. Inorganic compounds and the environment (1) (from an environmental science perspective): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
13. Inorganic compounds and the environment (2) (from an environmental science perspective): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
14. Inorganic compounds and bio-organisms (from a bio-chemical and physiological perspective): Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
15. Overall summary and comprehension test: Check the distributed materials and arrange the contents. To check the points in the next lesson those are hard to understand before the lecture.
16. Explanation of test solutions etc.

[Keywords]Inorganic materials, Reaction mechanism, Environmental science, Biochemistry

[Textbooks and Reference Books] Textbooks : Shriver and Atkins Inorganic Chemistry, Basic Inorganic Chemistry (Asakura）
[Evaluation] Evaluated based on evaluation of exercises for checking the understanding level that are conducted once every three lectures, and test scores of the understanding level tests.　Exercises: Test = approximately 1:3 is the plan.
[Course requirements] Students must have taken “Inorganic Chemistry I”.

有機化学 II　Organic Chemistry II
[Instructor] Shiki Yagai
[Credits] 2
[Semester] 2nd year-Spring-Thurs 2
[Course code] T1M105101
[Room] Bldg. ENG-5-204
[Candidate] Specially Registered Non-Degree Student may take this course.
[Course description] Like the continuation of "Organic Chemistry I", the basis of organic chemistry, as well as properties and reactions of organic compounds (alcohol, ether, alkene-alkyne compound, radicals, dienes, and allelic compound)
[Course objectives] Additional reactions of alcohol, ether, and alkene-alkyne, as well as radicals will be lectured. To deepen students' understanding of those basic principles through classes and exercises. Accomplishment goal:(1) To understand the synthesis and reaction of alcohols and ethers, (2) to understand the basic principle of addition reaction to alkene-alkyne compound, (3) to understand the basic principle of radical reaction, and (4) to understand properties and reactions of dienes, and allylic compounds. The many important matters regarding organic chemistry that should learn with department level will be taught, so students are required to concentrate for learning. Enjoy organic chemistry!
[Plans and Contents]
1. Guidance on teaching method, policy etc. and explanation of the basics for learning organic chemistry
2. Properties and syntheses of alcohols (1): Read the Chapter 8 and prepare the lecture.
3. Properties and syntheses of alcohols (2): Read the Chapter 8 and prepare the lecture.
4. Reactions of alcohols and chemistry of ethers (1): Read the Chapter 9 and prepare the lecture.
5. Reactions of alcohols and chemistry of ethers (2): Read the Chapter 9 and prepare the lecture.
6. Reactions of alkenes (1): Read the Chapter 12 and prepare the lecture.
7. Exercises (It is subject to be changed in accordance with class progress.)
8. Reactions of alkenes (2): Read the Chapter 12 and prepare the lecture.
9. Reactions of alkenes (3): Read the Chapter 12 and prepare the lecture.
10. Reactions of alkynes (1): Read the Chapter 13 and prepare the lecture.
11. Reactions of alkynes (2): Read the Chapter 13 and prepare the lecture.
12. Delocalized pi electron system (1): Read the Chapter 14 and prepare the lecture.
13. Delocalized pi electron system (2): Read the Chapter 14 and prepare the lecture.
14. Delocalized pi electron system (3) and summary of contents so far: Read the Chapter 14 and prepare the lecture.
15. End-of-term exam
16. Explanation of end-of-term exam

[Keywords] Organic Chemistry、Organic Synthesis、Alcohol、Ether、Alkene、Alkyne、Radical Reaction、Addition Reaction, pi Electron system, pi Conjugated system
[Textbooks and Reference Books] 「Vollhardt and Schor Organic Chemistry: 6th edition,」（Kagakudojin）
[Evaluation] The following ratio will be used for overall judgment generally. Exercises of each session that is used for attendance check as well (40%), and term-end examination (60%). The contents and difficulty level of the term-end examination is equivalent to the matters which are described in the accomplishment goal of this subject. In order to obtain credits, students are required to take the term-end examination, and the overall points which include exercises need to be over 60 points.
[Related courses] "Organic Chemistry I", "Organic Chemistry III", and "Organic Chemistry IV".
[Course requirements] Students have preferably taken "Organic Chemistry I".
[Remarks] During the lecture, there will be problem exercises that will also serve as attendance checking, so be sure to submit your answers. As a general rule, the number of attendance should be more than 4 out of 5 to obtain a credit. In the event that cheating is detected during the examination, acquisition of the credit would be withheld. And the relevant students will be punished in accordance with the school rules.

生物学入門　　Fundamentals of Biology
[Instructor] Daisuke Umeno
[Credits] 2
[Semester] 2nd year-Spring-Tues 5
[Course code] T1M106001
[Room] Bldg. ENG-2-103
[Course enrollment] 80
[Candidate] Students of faculty of Engineering and those of the 2nd year of Department of Applied Chemistry and Biotechnology may take this course. Enrolment is limited to 80 so that all students can see the blackboard writing and PowerPoint materials clearly.
[Course description] The lectures is given to students who have not taken biology course in high school; to fill the gap to "University Level", homework will be given almost every day.
[Course objectives] (General Goal) the biology is the area of study that creates new possibility in engineering. The living things on earth are formed by biopolymers used elements on earth. The goal of the lecture is to understand what is living and what makes living organisms different from non-living.　(Targeted Goal) (1) To understand the basic concept and terms of biology, and be able to explain them.　(2) To have interest in social and technical problems whereby biology relates, and be able to examine it scientifically.
[Plans and Contents] Lectures on the following items will be conducted over 16 lectures. Both blackboard and PowerPoint will be used. Printouts on the lecture contents will be distributed at the start of each lecture to aid understanding and report topics will be distributed for revision and preparation purposes at the end of the lecture.

1. Living things and cells
2. Cell size and the shape
3. Cell membrane and cell wall
4. Organelle and genome
5. Replication and division
6. Transduction of genetic information
7. Biological information processing
8. Metabolism (1)
9. Metabolism (2)
10. Heredity and evolution 1
11. Heredity and evolution 2
12. Another heredity: prion and epigenomics?
13. Life and the earth
14. Biotechnology
15. New wave of life science
16. Final Exam.

[Keywords] Living organisms, molecular biology, genetics, cell, protein, metabolism, information prcessing, environment.
[Textbooks and Reference Books] No textbook is specified.
[Evaluation] Class attendance is a prerequisite for evaluation. The evaluation is given by the reports collected for each lecture (30 points) and the examination (70 points). The evaluation shall be emphasized on the understanding of concepts, rather than on the memorizing the terms.

安全工学　Safety Engineering
[Instructor] Yuji Sasanuma, Takashi Karatsu, Nobuyuki Ichikuni, Motohiro Akazome, Motoi Machida, Takeru Sano
[Credit] 2
[Semester] 2nd year-Spring-Mon 3, 4 alternate week 1, 3
[Course code] T1M107001, T1M107002
[Room] Bldg. ENG-5-105
[Candidate] For students whose Student ID NO. is odd.
[Course description] In the study and manufacture of materials, there is a risk in the work and experiments, therefore, it is the obligation of the engineers and scientists to have the Knowledge to ensure the safety and avoid risk. Along with the workers' accidents, here are some samples that will be lectured on safe handling of radiation, high-pressure gas, and chemicals. This lecture will also be about the required contents and method of learning on "Class A Hazardous Materials Engineer's license" exam. This is an omnibus lecture
[Course objectives] General Objective:
To learn the concept of safety management through workmen's accident cases, and to understand the method for safe treating of radiation, high-pressure gas and chemicals. Acquire the knowledge to carry out experiments safely through student experiment, and graduate studies. Achievement Objective: There are cases wherein the students have to deal with high-pressure gas, radiations, and "poisonous and deleterious substances" in experiments and research study, the student will acquire the knowledge on how to conduct safe experiments. Students to take a "Class A Hazardous Materials Engineer's license" exam, to be able to pass the Exam on Nov. in Chiba, have to acquire an overview of studying method of the Exam, laws related to hazardous materials, properties, fire prevention and extinguishing method of the hazardous materials.
[Plans and Contents]
1. (Apr 13: Machida) Overall guidance, examples of accidents and work-related injuries 1
2. (Apr 27: Machida) Examples of accidents and work-related injuries 2
3. (May 18: Sano) High-pressure gas (Questions are only accepted at the end of the lecture or by e-mail.)
4. (Jun 1: Ichikuni) Radiation: Look into at least 2 examples on the use of radiation application prior to the lecture
5. (Jun 15: Karatsu) Chemical substances
6. (Jun 29: Akazome) Hazardous Materials Engineer1: Explanation of qualifications, how to study for a licence; Overview of laws governing hazardous materials: Textbook used is "Immediate Pass! Class A Hazardous Material Engineers' Test and Exercises (published by Natsumesha Co., edited by Motohiro Akazome)". In addition, add for a pass in the Nov exam through self-study.
7. (Jul 13: Sasanuma) Hazardous Materials Engineer 2: Properties of hazardous materials, fire prevention and extinguishing methods for hazardous materials.
8. (Aug 3) Supplementary lecture may be conducted due to lecture cancellation. Instruction will be given separately if the lecture is going to be conducted.

[Keywords] Safety management, Case study of work-related injuries, Radiation, high-pressure gas, Chemical substances, Hazardous materials engineer
[Textbooks and Reference Books] Informed by each instructor. For the 6th and 7th lectures, above-mentioned textbook "Immediate Pass! Class A Hazardous Material Engineers' Test and Exercises (published by Natsumesha Co., edited by Motohiro Akazome)" is used.
[Evaluation] Each instructor shall make a student submit a report and take the test, and will evaluate a student according to the total score. For 6th lecture, the evaluation is performed based on the practice test related to the regulation laws conducted at the end of the class. (In the National examination, 60% correct answers are required).
[Remarks] For students whose Student ID NO. is odd. Students can not obtain the credit, who will not meet attendance regulations.

安全工学　Safety Engineering
[Instructor] Yuji Sasanuma, Takashi Karatsu, Nobuyuki Ichikuni, Motohiro Akazome, Motoi Machida, Takeru Sano
[Credits] 2
[Semester] 2nd year-Spring-Mon 3, 4 alternate week 2, 4
[Course code] T1M107003, T1M107004
[Room] Bldg. ENG-5-105
[Candidate] For students whose Student ID NO. is even.
[Course description] In the study and manufacture of materials, there is a risk in the work and experiments, therefore, it is the obligation of the engineers and scientists to have the Knowledge to ensure the safety and avoid risk. Along with the workers' accidents, here are some samples that will be lectured on safe handling of radiation, high-pressure gas, and chemicals. This lecture will also be about the required contents and method of learning on "Class A Hazardous Materials Engineer's license" exam. This is an omnibus lecture
[Course objectives] General Objective:
To learn the concept of safety management through workmen's accident cases, and to understand the method for safe treating of radiation, high-pressure gas and chemicals. Acquire the knowledge to carry out experiments safely through student experiment, and graduate studies. Achievement Objective: There are cases wherein the students have to deal with high-pressure gas, radiations, and "poisonous and deleterious substances" in experiments and research study, the student will acquire the knowledge on how to conduct safe experiments. Students to take a "Class A Hazardous Materials Engineer's license" exam, to be able to pass the Exam on Nov. in Chiba, have to acquire an overview of studying method of the Exam, laws related to hazardous materials, properties, fire prevention and extinguishing method of the hazardous materials.
[Plans and Contents]
1. (Apr 20: Machida) Overall guidance, examples of accidents and work-related injuries 1
2. (May 11: Machida) Examples of accidents and work-related injuries 2
3. (May 25: Sano) High-pressure gas (Questions are only accepted at the end of the lecture or by e-mail.)
4. (Jun 8: Ichikuni) Radiation: Look into at least 2 examples on the use of radiation application prior to the lecture
5. (Jun 22: Karatsu) Chemical substances
6. (Jul 6: Akazome) Hazardous Materials Engineer1: Explanation of qualifications, how to study for a licence; Overview of laws governing hazardous materials: Textbook used is "Immediate Pass! Class A Hazardous Material Engineers' Test and Exercises (published by Natsumesha Co., edited by Motohiro Akazome)". In addition, add for a pass in the Nov exam through self-study.
7. (Jul 27: Sasanuma) Hazardous Materials Engineer 2: Properties of hazardous materials, fire prevention and extinguishing methods for hazardous materials.
8. (Aug 3) Supplementary lecture may be conducted due to lecture cancellation. Instruction will be given separately if the lecture is going to be conducted.

[Keywords] Safety management, Case study of work-related injuries, Radiation, high-pressure gas, Chemical substances, Hazardous materials engineer
[Textbooks and Reference Books] Informed by each instructor. For the 6th and 7th lectures, above-mentioned textbook "Immediate Pass! Class A Hazardous Material Engineers' Test and Exercises (published by Natsumesha Co., edited by Motohiro Akazome)" is used.
[Evaluation] Each instructor shall make a student submit a report and take the test, and will evaluate a student according to the total score. For 6th lecture, the evaluation is performed based on the practice test related to the regulation laws conducted at the end of the class. (In the National examination, 60% correct answers is required).
[Remarks] For students whose Student ID NO. is even. Students can not obtain the credit, who will not meet attendance regulations.

分析化学 I　Analytical Chemistry I
[Instructor] Masanori Fujinami
[Credits] 2
[Semsester] 2nd year-Spring-Tues 2
[Course code] T1M110101
[Room] Bldg. ENG-2-202
[Course enrollment] 100
[Candidate] Students of Department of Applied Chemistry and Biotechnology must take this course.
[Course description] In “Analytical Chemistry I and II”, the student will learn the volumetric analysis based on equilibrium theory, electrochemical analysis, and molecular and atomic spectra using light, separation analysis, and biochemical analysis. It is strongly recommended that the students get credits of both courses.
[Course objectives] Thinking about the separation and detection, both are the keywords of analytical chemistry, the student will learn the concepts of this methodology.　Especially in “Analytical Chemistry I”, it is aimed for the students to be able to discuss the concept of the analytical method that uses light and the importance of pH.
[Plans and Contents] To be able to download the viewgraph that is used in the lecture that would contribute to the understanding of the content.　Also a task will be given at each lecture, and a short test relating the task will be taken in the course of the next week.

1. What is analytical chemistry?
2. Value of neutralization titration: Study on topics given in the first lecture.
3. Optical analysis method - Spectrophotometry: Study on topics given in the second lecture.
4. Fluorescence spectroscopy: Study on topics given in the 3rd lecture.
5. Spectroscopic analysis equipment and chemi-luminescent spectroscopy: Study on topics given in the 4th lecture.
6. Atomic spectrum: Study on topics given in the 5th lecture.
7. Microanalysis: Study on topics given in the 6th lecture.
8. pH titration - Acid-base equilibrium (1): Study on topics given in the 7th lecture.
9. pH titration - Acid-base equilibrium (2): Study on topics given in the 8th lecture.
10. Verification of current understanding: Study on topics given in the 9th lecture.
11. Chelatometric titration (1): Study on topics given in the 10th lecture.
12. Chelatometric titration (2): Study on topics given in the 11th lecture.
13. Precipitation titration: Study on topics given in the 12th lecture.
14. Ion exchange: Study on topics given in the 13th lecture.
15. Summary and verification of current understanding.

[Keywords] solution chemistry,　Physical Chemistry
[Evaluation] There will be mid-term and final exams given to verify that the students have at least learned to attain the objectives of this course. The points of both exams will be used for evaluation. If the three successive scores of short tests carried out at each lecture are less than the passing mark, the record of this course will automatically become F (Failure). If the cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Experiment in Analytical Chemistry, Analytical Chemistry II
[Course requirements] Not particularly
[Remarks]

物理化学 II　Physical Chemistry II
[Instructor] Minoru Seki
[Credits] 2
[Semester] 2nd year-Fall-Thurs 1
[Course code] T1M112001
[Room] Bldg. ENG-2-103, Bldg. ENG-17-112 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Candidate]Students of faculty of Engineering,Other Faculties, and Specially Registered Non-Degree Student.
[Course description] The student will learn about the physico-chemical concepts on the chemical reaction rate. In order to deal quantitatively with a chemical reaction, equilibrium theory and kinetic way of thinking are both important to work closely together as a pair of wheels. The former has been studied in "Physical Chemistry I". The latter is the content of this lecture, and the student will learn of the basic and important concept involved in almost all of the subjects in Chemistry.
[Course objectives]
(Purpose) Learn and to be able practice the definition, measuring methods, and expression of chemical reaction rate, the prediction of chemical reaction using the rate equations, and the estimation of reaction mechanism by kinetics. By applying the kinetic concepts, the student will understand the representation method and reaction mechanism of more complex reactions such as chain reaction, polymerization reaction, auto catalytic reaction etc. In addition, the student will also understand the quantitative description of the reaction rate by thinking of molecular dynamics.
(Target Achievement)
(1) To understand and explain the definition, measurement method and representation of chemical reaction rate.
(2) Can derive a rate equation from experimental results.
(3) To be able to predict the chemical reaction with the reaction rate equation.
(4) Be able to derive the rate equation by assuming the reaction mechanism.
(5) Be able to estimate the reaction mechanism from the experimental results.
(6) By applying the kinetic concept, be able to understand how to represent the reaction rate and reaction mechanism of complex reactions, such as chain reaction, polymerization and auto-catalytic reaction, and to derive the rate equations.
(7) The student must be able to explain quantitatively the reaction rate by using molecular dynamics.
[Plans and Contents]
Lectures will be conducted based on Chapter 22-24 (including parts of Chapter 21) of the textbook "Atokins Physical Chemistry (Part 2) 8th Ed." In addition, exercises, quizzes, reports (assignments) etc. will also be carried out for a more in-depth understanding where necessary. The level of comprehension will be verified through the regular submission of exercise reports. An outline of each lecture is shown below.

1. The rates of chemical reactions (1); experimental techniques for reaction rate measurement, definition of reaction rate, reaction rate equations, rate constant, and reaction order.
2. The rates of chemical reactions (2); determination of rate equation, integrated rate equation, first-order reaction, and half-life.
3. The rates of chemical reactions (3); second-order reaction, and reactions approaching equilibrium.
4. The rates of chemical reactions (4); temperature dependence of reaction rate, accounting for rate equation, and elementary reaction.
5. The rates of chemical reactions (5); consecutive elementary reaction, steady-state approximation, and rate-determining step.
6. The rates of chemical reactions (6); pre-equilibrium, kinetic isotope effect, and uni-molecular reactions.
7. Problem exercise (1); chemical reaction rate: Answers to questions at the end of the chapter in the textbook are required to be submitted in advance as a report and explained during the lectures.
8. The kinetics of complex reactions (1); rate equation of chain reactions, and explosive reaction.
9. The kinetics of complex reactions (2); homogeneous catalysis and enzyme reaction.
10. The kinetics of complex reactions (3); photochemical reactions.
11. Problem exercise (2); examples of reaction mechanisms: Answers to questions at the end of the chapter in the textbook are required to be submitted in advance as a report and explained during the lectures.
12. Molecular reaction dynamics (1); molecular motion in gasses and collision theory.
13. Molecular reaction dynamics (2); diffusion-controlled reactions and material balance equation.
14. Molecular reaction dynamics (3); transition state theory and molecular collision kinetics.
15. Problem exercise (3); molecular reaction dynamics: Answers to questions at the end of the chapter in the textbook are required to be submitted in advance as a report and explained during the lectures.
16. End-of-term examination.

[Keywords] Chemical kinetics, rate of reactions, rate equation, rate constant, reaction order, half-life, Arrhenius equation, activation energy, elementary reaction, consecutive reaction, rate-determining step, steady-state approximation, chain

reaction, explosion, photochemical reaction, polymerization, autocatalytic reaction, collision theory, diffusion control, activated complex theory, reaction coordinate, and transition state.
[Textbooks and Reference Books] Textbook: “Atkins Physical Chemistry (8th ed.)” by Peter Atkins and Julio de Paula, translated into Japanese by Hideaki Chihara and Nobuo Nakamura, Tokyo Kagaku Dojin (2009). Mainly Ch. 22-24 of the textbook will be used (Ch.21 is partially used).
[Evaluation] Scores of the end-of-term examination (80-90%) and reports (assignments) (10-20%) are used for evaluation. Since the assignments outside of the classroom are required to achieve the above-mentioned targets, answering on your own is a very important process. Therefore, the report evaluation shall be made on whether or not the attempt to try to answer all issues carefully. For late submissions, the student will be penalized according to the degree of the delay. Since the end-of term examination is intended to evaluate the degree of achievement of the target, the percentage of correct answers shall be evaluated. Total of both scores are not to be less than 60 points.
[Related courses] Physical Chemistry I
[Course requirements] Attendance must be at least 2/3. (For students who are re-taking this course, however, the results for the previous year will be taken into consideration. To offer at the first lecture.)

電気化学　Electrochemistry
[Instructor] Nagahiro Hoshi
[Credits] 2
[Semester] 2nd year-Fall-Wed 1
[Course code] T1M113001
[Room] Bldg. ENG-5-204
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] Electrochemistry has the following major advantages in the field of chemistry:
(1)Conversion of a stable substance under ambient pressure and temperature
(2)Control electrochemical reaction rate and selectivity by changing surface structure of electrode and electrode potential
Therefore, an electrochemical method is the key technology to convert energy and materials without pollution of natural environments. Basic theory and methods of electrochemistry will be lectured in this class.
[Course objectives] Electrochemical reaction can convert chemical energy to electrical energy directly. The relation between chemical and electrical energies is lectured on the basis of thermodynamics. Students will obtain the following knowledge of fundamental electrochemistry.
(1)Nature of the electrolyte solution
(2)Structure of the electrode interface that significantly affects the activity of the electrode reaction
(3)Dynamics of electrochemical reaction
(4)Fuel cells and state-of-the-art electrochemical topics that has been attracting attention in recent years
The goal of this class is to acquire the skills for calculation of the equilibrium potential and dynamic currents that are required in the fundamental and applied field of electrochemistry.
[Plans and Contents] Lectures will be conducted according to the following lesson plan. A report is required after each lecture.

1. Electrolyis and galvanic battery ◆Preparation required: Read the relevant sections of the textbook.
2. Conductivity ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
3. Theory of ionic dissociation ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
4. Transport number of ions ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
5. Mobility and activity of ions ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
6. Debye-Hückel theory ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
7. Debye-Hückel limiting law ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
8. Theory of electrical conduction and potential ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
9. Nemst equation and electromotive force of batteries ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
10. Half-cell and standard electrode potential ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
11. Concentration cell and pH measurement methods ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
12. Concept of electric double layer ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
13. Rate of electrode reaction (Butler-Volmer equation and Tafel equation) ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
14. Fuel cells ◆Preparation required: Submit the assignment given during the lecture by the prescribed date and time.
15. Overall summary
16. End-of-term exam.

[Keywords] conductivity, transport number, mobility, activity, Debye-Hückel theory, Nernst equation, electrode potential, electric double layer, current, Butler-Volmer equation, Tafel equation, fuel cell
[Textbooks and Reference Books] Yoshiharu Matuda, Chiaki Iwakura, “Introduction of Electrochemistry” (Baifukan) ISBN 978-4-621-086680-3

[Evaluation] Grade is given in the ratio (assignment)/(final exam) = 1/10. The student who has been absent more than 4 times in the lectures cannot take the end-of term exam. Additional exam will be done only once. However, students who have not acquired a score of 35 points in the end-of-term exam cannot take the additional exam. The grade of students who pass the additional exam is C (pass). The deadline for the submission of the assignments is at 13:00 Friday of the same week of the lecture. If a student is caught cheating, he or she will be punished according to the school rules and regulations.
[Related courses] Physical Chemistry I
[Course requirements] Students are encouraged to take “Physical Chemistry I”.

固体化学 Solid State Chemistry
[Instructor] Takashi Kojima
[Credits] 2
[Semester] 2nd year-Fall-Mon 4
[Course code] T1M114001
[Room] Bldg. ENG-5-204
[Course description] Many materials are used in our daily lives such as electromagnetic materials, optical electronics materials. A variety of different characteristics in these materials are closely related to the crystal structure of the material. Firstly, in this lecture, the student will study a basic knowledge and common notation of lattices and crystals. On the other hand, the electrical conductivity properties, such as thermal conductivity cannot be discussed without taking the lattice defects. Therefore the lecture will be not only about point defects generated in the crystal, but also a variety of lattice defects, line defects (dislocations), and surface defects (such as grain boundaries, stacking faults).
[Course objectives]
(Purpose) Acquire the basic knowledge and common notation of lattices and crystals to understand the characteristics of crystalline solid materials.
(Achievement Target)
(1) The student will understand the classification by the crystal binding mode, and what kind of crystal.
(2) Because the ion crystals use the refill of the anions as basics, first, the student has to understand the method of filling the sphere.
(3) The stability of the ionic crystal is discussed in terms of binding energy.
(4) On the stability of the crystal, discuss the geometrical limit together with the terms of binding energy.
(5) The student will learn how repeating units are discussed in terms of the crystal.
(6) Learn how to determine the existence of crystal defects and study the usefulness of this as a material.
(7) Be aware of the useful features shown above.
[Plans and Contents] Metals and ceramics are mostly structured from crystals. To understand them, it is essential studying about the basics of crystals. The student will understand the fundamentals of crystal in this course, to solidify the basics of learning inorganic material chemistry.
1. Outline of the course, Outline of solid state chemistry: (Extracurricular learning) Go through the syllabus of this course.
2. Types of crystal: (Extracurricular learning) Go through Section 1.1.1.2 in the textbook.
3. Sphere packing: (Extracurricular learning) Go through Section 1.2 in the textbook.
4. Representation of atomic positions in a crystal: (Extracurricular learning) Go through Section 1.2 in the textbook.
5. Pauling's rules (1st rule): (Extracurricular learning) Go through Section 1.3b in the textbook.
6. Pauling's rules (2nd -5th rules): (Extracurricular learning) Go through to the end of Section 1.3b in the textbook.
7. Unit cell, Bravais lattice: (Extracurricular learning) Go through Section 1.3 in the textbook.
8. Summary of the first half lectures and verification of understanding level (midterm exam)
9. Coordinates, direction index, facial index: (Extracurricular learning) Go through Section 2.2 in the textbook.
10. Symmetry and space group: (Extracurricular learning) Go through Section 2.3 in the textbook.
11. Lattice energy: (Extracurricular learning) Go through Section 1.3 in the textbook.
12. Point defect: (Extracurricular learning) Go through Section 3.1 in the textbook.
13. Defect chemistry: (Extracurricular learning) Go through to the end of Section 3.1 in the textbook.
14. Line defect, dislocation: (Extracurricular learning) Go through to the end of Section 3.2 in the textbook.
15. Overall summary and and verification of understanding level (end-of-term exam).
16. Recapitulation and explanation of end-of-term exam.

[Keywords] crystal, lattice energy, Pauling's rules, Bravais lattice, lattice constant, transformation, crystal growth, defect chemistry, dislocation (line defect)
[Textbooks and Reference Books] Kakegawa et al., Crystal Chemistry (Kessyou Kagaku), Mimizuku Sya
ISBN978-4-87211-921-3
[Evaluation] Scores of the midterm exa (30%), end-of-term exam (40%), and the attendance short test (30%) will be used for evaluation. Students should present more than 80% of lectures.
[Related courses] Inorganic Chemistry I, Inorganic Chemistry II
[Course requirements] Students have preferably taken course of "Inorganic Chemistry I".
[Remarks] Office hour: Friday, as a general rule.

有機化学 III　Organic Chemistry III
[Instructor] Takashi Mino
[Credits] 2
[Semester] 2nd year-Fall-Tues 1
[Course code] T1M115101
[Room] Bldg. ENG-5-204
[Candidate]Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description] Following “Organic Chemistry ll”, the nature of organic compound (aromatic compounds, carbonyl compounds) and their basic reaction shall be explained.
[Course objectives]
(Purpose) The student will have a deeper understanding on the conjugation and aromaticity, the properties and reactions of aromatic compounds and carbonyl compounds (aldehydes, ketones, carboxylic acids), through teaching and homework exercises.　In particular, the student will master on how to move the electron in the reaction mechanism.
(Achievement Targets)
(1) Understand the nomenclature of aromatic compounds, properties, and synthesis. (1st, 2nd, 3rd, 8th, 15th lectures)
(2) Understand the reaction of aromatic compounds. (4th, 5th, 6th, 8th, 15th lectures)
(3) Understand the nomenclature, nature, synthesis and reaction of aldehydes and ketones. (7th, 8th, 9th, 15th lectures)
(4) Understand the reaction of the enol-enolate.　(10th, 11th, 12th, 15th lectures)
(5) Understand the nomenclature, nature, synthesis and reaction of the carboxylic acid.　(13th, 14th, 15th lectures）
[Plans and Contents] Chapters 15, 16, 17, 18 and 19 of the specified textbook will be explained in this course in order to master organic chemistry.

1. Guidance on teaching method and policy etc., conjugation and aromaticity (1): Teach the nomenclature, structure, resonance structural formula and molecular orbital of benzene.　Required preparation: Read Chapter 15 of the textbook.　Extracurricular studies: Questions on resonance structural formula and description of molecular orbit will be given as homework.
2. Conjugation and aromaticity (2): Teach the generalization of aromaticity and annulene. Required preparation: Read Chapter 15 of the textbook. Extracurricular studies: Questions on the frost circle will be given as homework.
3. Substitution reaction of benzene: Teach electrophilic reaction, Friedel-Crafts reaction. Required preparation: Read Chapter 15 of the textbook. Extracurricular studies: Questions on the mechanism of the Friedel-Crafts reaction will be given as homework.
4. Substitution reaction of benzene derivatives (1): Teach the electrophilic reaction of monosubstituted benzene. Required preparation: Read Chapter 16 of the textbook. Extracurricular studies: Questions on the mechanism of the electrophilic reaction orientation will be given as homework.
5. Substitution reaction of benzene derivatives (2):　Teach the electrophilic reaction and composite uses of disubstituted benzene and multi-substituted benzene. Required preparation: Read Chapter 16 of the textbook. Extracurricular studies: Questions on substituted benzene will be given as homework.
6. Chemistry of carbonyl group: Teach the structure and naming of carbonyl groups. Required preparation: Read Chapter 17 of the textbook. Extracurricular studies: Questions on mastering the naming of carbonyl compounds will be given as homework.
7. Chemistry of carbonyl group: Reaction (1): Teach reversible reactions, acetal composition, protecting group, and addition reaction of amines. Required preparation: Read Chapter 17 of the textbook. Extracurricular studies: Questions on the composition mechanism of acetal will be given as homework.
8. Summary on conjugation and aromaticity, aromatic compounds and carbonyl group chemistry and interim exam: Check the contents of Chapters 15, 16, 17 (Sections 17-1 – 17-4) again. Required preparation: Revise the lesson contents from the 1st to the 7th lectures. Extracurricular studies: Questions on carbonyl groups will be given as homework.
9. Chemistry of carbonyl group：　Reaction (2): Teach de-oxygenation, addition of hydrogen cyanide and Wittig reaction. Required preparation: Read Chapter 17 of the textbook. Extracurricular studies: Questions on the mechanism of the Wittig reaction will be given as homework.
10. Chemistry of carbonyl group：α-position reaction (1): Teach the properties of aldehyde ketones, enols and enolates. Required preparation: Read Chapter 18 of the textbook. Extracurricular studies: Questions on the mechanism of enols and enolates will be given as homework.
11. Chemistry of carbonyl group：α-position reaction (2): Teach the addition reactions of carbonyls and aldol reactions. Required preparation: Read Chapter 18 of the textbook. Extracurricular studies: Questions on aldol reaction will be given as homework.

12. Chemistry of carbonyl group：α-position reaction (3): Teach α, β-unsaturated carbonyl compounds and their reactions. Required preparation: Read Chapter 18 of the textbook. Extracurricular studies: Questions on the addition reaction of α, β-unsaturated carbonyl compounds will be given as homework.
13. Chemistry of carboxylic acid(1): Teach the structure and naming method. Required preparation: Read Chapter 19 of the textbook. Extracurricular studies: Questions on mastering the naming method of carboxylic acids will be given as homework.
14. Chemistry of carboxylic acid(2): Teach carboxylic acids and the composition of their derivatives. Required preparation: Read Chapter 19 of the textbook. Extracurricular studies: Questions on mastering carboxylic acids and the composition of their derivatives will be given as homework.
15. Summary on carbonyl group chemistry (aldehydes, ketones, carboxylic acids) and end-of-term exam: Go through the contents of Chapters 15-19 of the textbook again. An end-of-term exam will be conducted for required learning outcomes to assess the level of achievement. Required preparation: Revise the contents in the 1st – 14th lectures.
16. Summary of aromatic compounds, carbonyl group chemistry, explanation of the end-of-term exam. Required preparation: Revise the contents of the 1st - 15th lectures.

[Keywords] Organic chemistry, Organic synthesis, Organic reaction, Reaction mechanism, Nomenclature
[Textbooks and Reference Books] (Textbook) [Vollhardt and Schore's Organic Chemistry the second volume Sixth Edition] (Kagakudojin) (Reference books) [Study Guide/Solutions Manual for Vollhardt and Schore's Organic Chemistry Sixth Edition] (Kagakudojin), Jones's Organic Chemistry the first and second volumes] (Tokyokagakudojin)
[Evaluation] Evaluation shall be based on Quizzes and reports (40%), Interim Exam (20%), End-of-term Exam (40%). Questions in Interim and End-of-term Exams are equivalent to the content and difficulty level of achievement that is listed in the goals and objectives of this course. The overall weight of each target to be approximated is as follows. Achievement Target (1): 20%, Achievement Target (2): 30%, Achievement Target (3): 15%, Achievement Target (4): 15%, Achievement Target (5): 20%. To get the credits of this course, take the Interim and End-of-term Exams and it is necessary for overall score which is greater than or equal to 60 points. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Basic Chemistry B, Organic Chemistry I, Organic Chemistry II、Organic Chemistry IV
[Course requirements] Students have preferably taken course of Organic Chemistry II.
[Remarks] As a general rule, more than four-fifths attendances will be the prerequisite for earning credits. Being late for the class will be subject to deduction. Grade distribution for the past 3 years will be shown as a reference.
2011 Excellent: 16.5% Good: 34.9% Satisfactory: 32.1% Pass: 8.3% Fail: 8.3% Average score: 2.43.
2012 Excellent: 12.1% Good: 41.1% Satisfactory: 30.8% Pass: 8.4% Fail: 7.5% Average score: 2.42.
2013 Excellent: 12.1% Good: 31.0% Satisfactory: 28.4% Pass: 19.0% Fail: 9.5% Average score: 2.17.

生化学 I　Biochemistry I
[Instructor] Daisuke Umeno
[Credits] 2
[Semester] 2nd year-Fall-Fri 1
[Course code] T1M116001
[Room] Bldg. ENG-2-202, Bldg. ENG-5-105 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 75
[Candidate] Students of faculty of Engineering,and students should have preferably taken courses of Biomolecular Chemistry and Fundamentals of Biology.
(This course is assumed the understanding of these 2 courses). Class Enrollment is limited to 75. Take Assigned Seat System.
[Course description]　Learn the basic chemical principle governing the cells. This course consists of four parts: (1) We study chemical composition and origin of organisms and cells, (2) structure, physical properties and research methods of nucleic acids, (3) nature, function and research methods of proteins and enzymes, and (4) how biochemical reactions should be studied.
[Course objectives]
(General objectives) The student will understand the structure and physical properties of proteins and nucleic acids, as well as how enzymatic reactions take place.
(Achievement Targets)
(1) To understand the structure and physical properties, in terms of physical chemistry, organic chemistry of DNA.　(2) To understand what types of molecular interactions shape up the structure of proteins.(3) To understand what makes　enzymes different from other catalytic entities. (4) To learn the molecular logic that enables thousands of biomolecules work together without confusion, in the sea of molecules.
[Plans and Contents] 15 lectures will be conducted (16 including the end-of-term exam).
1. Placement test,　cytochemistry
2. Cell membrane and cell wall
3. Nucleic acid structure
4. 4. Double helix
5. Double strand formation and stability
6. Replication and research methods of nucleic acid
7. Functions and structure of proteins
8. Structure of proteins
9. Folding and denaturation of proteins
10. Enzyme as a catalyst
11. Enzymatic reaction
12. Kinetics
13. Enzyme regulation, inhibitor and allosteric regulation
14. Coupling reaction with ATP
15. End-of-term exam

[Keywords] DNA and gene, protein and folding, enzyme kinetics, information processing, synthetic biology
[Textbooks and Reference Books] Biochemistry (Morikita Syuppan), Sugimori Daisuke et al., ISBN798-4-627-24571-6
[Evaluation] At least 12 attendances (mini-report to be submitted each time) is a pre-requisite to sit for the end-of-term exam. Evaluation to be carried out based on the reports collected for each lesson (15 points: provided they are pre-requisites for taking the test), end-of-term exam (60 points: to be conducted at the end of the year), theme reports (to be submitted at any time: 25 points), making a total of 100 points. 3 theme reports shall be submitted. In particular, students with a high level of understanding who possess 2 basic qualities of a scientist – originality and logic / accuracy – will be given a higher score.
[Related courses] Biomolecular Chemistry (3rd semester), Fundamentals of Biology (3rd semester), Biochemistry II (5th semester), Molecular Biology (6th semester).
[Course requirements] Student must have taken course of Biomolecular Chemistry. Also, students have preferably taken course of Fundamentals of Biology.
[Remarks] Students of Biotechnology Course (Department of Applied Chemistry and Biotechnology) must take this course! Office hour: Thursday and Saturday afternoon (1300-1700: Students must take an appointment: Bldg.ENG-1-313).

化学工学基礎 Fundamentals in Chemical Engineering
[Instructor] Satoshi Sato
[Credits] 2
[Semester] 2nd year-Fall-Tues 2
[Course code] T1M117001
[Room] Bldg. ENG-5-204
[Course enrollment] 110
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] In this lecture there will be explanations and exercises on the fundamentals of chemical engineering of material balance and energy balance, fluid flow and transport, heat transfer and heat exchange experiment, and distillation.
[Course objectives] Not only knowledge about chemical reaction (chemical bond recombination), but also fundamental knowledge regarding heat transfer and mass transfer is also necessary to efficiently process large amounts of chemical raw materials. The understanding of the student will be intensified on the fundamentals of chemical engineering of transport and fluid flow, heat transfer and heat exchanger, distillation and rectification column, and the like. As goals, at least the 1) mass balance, 2) Reynolds number, 3) pressure loss and 4) heat exchanger will be properly understood.
[Plans and Contents] Teach the 4 items according to each unit in the specified textbook. Chapter 1: “Units and dimensions” as a bases of chemical engineering, “PVT relationship of a real gas”, “mass and energy balance calculations”; Chapter 2: “Flow rate, flow speed, flow state”, “flow energy balance”, “power requirement for fluid transport” with regards to flow and fluid transport; Chapter 3: “Thermal conduction”, “convective heat transfer”, “thermal design of a heat exchanger”, “performance test of a heat exchanger” with regards to heat transfer and heat exchangers; Chapter 4: “Gas-liquid equilibrium relationship”, “single distillation, steam distillation”, “vacuum distillation” with regards to distillation and rectification column.

1. Chapter 1Basics of chemical engineering: Units and dimensions ◆Required preparation: Get ready the textbook and prepare for the lesson by reading pp. 1-3 in Chapter 1 of the textbook.
2. P-V-T relationship of a real gas ◆Required preparation: Revise the scope given in the 1st lesson.
3. Substance and energy balance calculations ◆Required preparation: Revise the tutorial questions given in the 2nd lesson.
4. Substance and energy transfer phenomenon ◆Required preparation: Revise the scope given in the 3rd lesson.
5. Chapter 2 Flow and fluid transport: Flow rate, flow speed, flow state, 1st mini-test ◆Required preparation: Revise the scope given in the 1st - 4th lesson.
6. Flow-related energy balance ◆Required preparation: Revise the scope given in the 5th lesson.
7. Power requirement for fluid transport ◆Required preparation: Answer the tutorial questions given in the 6th lesson.
8. Measurement of flow rate and flow speed ◆Required preparation: Answer the tutorial questions given in the 7th lesson.
9. Chapter 3 Heat transfer and heat exchanger: Heat conduction, 2nd mini-test ◆Required preparation: Revise the scope given in the 5th - 8th lesson.
10. Convection heat transfer ◆Required preparation: Revise the scope given in the 9th lesson.
11. 11. 11. Thermal design of a heat exchanger ◆Required preparation: Revise the scope given in the 10th lesson.
12. Performance test of a heat exchanger ◆Required preparation: Revise the scope given in the 11th lesson.
13. Chapter 4 Distillation and rectifying column: Gas-liquid equilibrium function, 2nd mini-test ◆Required preparation: Revise the scope given in the 9th – 12th lesson.
14. 14. 14. Simple distillation, steam distillation, vacuum distillation◆Required preparation: Answer the tutorial questions given in the 13th lesson.
15. Comprehension check and supplementary explanation ◆Required preparation: Revise the lesson scope in Chapter 1–4 of the textbook.

[Keywords] Material balance, energy balance, flow, transportation of fluid, heat transfer, heat exchanger, distillation.
[Textbook]「Basics of Chemical Engineering, Applied Chemistry Series 4, Asakura Publisher,
[Evaluation] Submission of reports for specified tutorial questions is required as extracurricular studies. Evaluation is given by short test (3 times) (20%),final exam (80%). Both in short test and end-of-term exam will have a full score of 100 points and will correspond to the content and difficulty of matters that are listed in the goals of this course. To acquire a credit, take all the final exam and short tests, for a total score of at least 60 points that is required.
[Course requirements] Evaluated by conducting many exercises and reports, attendance of more than 4/5 is requisite.
[Remarks]

グリーンケミストリーGreen Chemistry
[Instructor] Satoshi Sato, Takashi Mino, Shoji Matsumoto, (Yuji Okita), (Akio Kayano), (Masashi Takahashi)
[Credits] 2
[Semester] 3rd year-Fall-Mon 3
[Course code] T1M118001
[Room] Bldg. ENG-5-204
[Course enrollment] 110
[Candidate] Students of faculty of Engineering.
[Course description] A specific example, the point of one's observation, philosophy inevitability regarding green chemistry chemical synthesis that does not produce environmental pollutants," key concepts that underlie the chemistry of the 21st century, will be lectured.
[Course objectives]
(Objective) The student will be able to understand the concept of green chemistry essay in order to reduce the environmental impact, as well as gain knowledge about safety that should be taken with responsibility regarding chemical-related technologies on society.
(Target achievement) The student will be able to discuss regarding Green Chemistry from the point of view of synthesis from the 2nd to 6th time of lectures. The student will be able to discuss matters that are required for chemical products from the viewpoint of green chemistry. The student will be able to debate as a member of the company, on what to do with the standards of conduct as an engineer from the 7th to 9th lectures. The student will be able to debate and understand the position as a chemist, as a member of society that heavily involved in environmental issues from the 10th to 12th lectures. The student will learn to recognize when involved in the chemical industry, as a member of society based on the illustration, be able to build a variety of plans and systems in the group from the 13th and 14th lectures.
[Plans and Contents]
1. Green chemistry and Applied Chemistry & Biotechnology <Intensive reading of Chapter 1 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.> (Mino)
2. Green chemical raw materials <Intensive reading of Chapter 2 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
3. Green substance conversion (homogeneous catalyst reaction) <Intensive reading of Chapter 7 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
4. Taking into consideration the Great East Japan Earthquake / Fukushima No. 1 Nuclear Plant Accident and related engineer, energy problems. <Check up thoroughly on news and events related to the engineers.> (Okita)
5. Corporate ethics, the role of a university, the moral values that a student should have, professional engineers (including engineering qualifications and Professional Engineer Act) <Check up thoroughly on news and events related to the engineers.>
6. Ethics and laws to a researcher or engineer, social responsibilities of organizations such as companies etc. <Check up thoroughly on news and events related to the engineers.>
7. Green chemical products <Intensive reading of Chapter 3 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.> (Matsumoto)
8. Green reaction media (water, super-critical fluids, fluoride solvents, ionic liquids) <Intensive reading of Chapter 12-14 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
9. Green chemistry and separation technology <Intensive reading of Chapter 4 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
10. Toxicity of chemical substances and related laws <Intensive reading of Chapter 6 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.> (Sato)
11. Life cycle assessment and green index <Intensive reading of Chapter 5 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
12. Green chemical conversion (selective oxidation reaction using solid catalysts, waste reduction) <Intensive reading of Chapters 8 and 9 of the textbook. After attending the lecture, read through the printouts etc. again for reference purposes and check up on unknown terms etc.>
13. Practical report from the manufacturing site (Part 1)
14. Practical report from the manufacturing site (Part 2)
15. Comprehension test and supplementary explanation

[Keywords] 12 principles of green chemistry, reaction solvent, material conversion, photocatalysis, solar cell, solid catalysts, material separation, bio-based polymers, toxic materials, polymer synthesis to reduce volatile organic compounds (VOC), recycle of plastics, ethics education.

[Evaluation] To evaluate comprehensively by conducting short tests/questionnaires (50%), and by students' understanding level (50%) including explanation of terms, balance calculation, and short essay.

[Remarks] Attendance will be emphasized. Evaluation will not be carried out for students who attend less than half the lectures conducted continuously by each instructor.

量子化学 Quantum Chemistry
[Instructor] Nagahiro Hoshi
[Credits] 2
[Semester] 3rd year-Spring-Thurs 1
[Course code] T1M120001
[Room] Bldg. ENG-5-204
[Candidate]Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description] The Quantum chemistry is a powerful tool for the elucidation of molecular structure and electronic distribution of molecular and radical exited state. Therefore, it is necessary for chemical researchers and engineers to know the fundamental concept of quantum chemistry. Basics of quantum chemistry will be lectured simply in the class.
[Course objectives] The Quantum chemical calculations predict molecular structures and electronic states, playing an important role in the field of physical chemistry as well as organic chemistry. Students will know the method how the electric structure of atoms and molecules are calculated using quantum chemistry. After studying the approximation method (perturbation theory, variation methods), students will learn the concepts of chemical bonding and molecular orbital using hydrogen ion molecule as an example. The student will also learn the electronic structure of conjugated and polyatomic molecules. The goal of this lecture is to acquire knowledge to calculate the energy levels, molecular orbital and the electron density of molecules in the size of benzene.
[Plans and Contents]
1. Review of quantum mechanics
2. Assumptions of quantum theory and operators (1) ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
3. Assumptions of quantum theory and operators (2) ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
4. Hydrogen atom ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
5. Principle of perturbation theory ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
6. Approximate solution of Schrödinger equation using perturbation theory ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
7. Approximate solution of Schrödinger equation using the variational method ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
8. Excited state of helium ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
9. Multi-electron atoms ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
10. Electron configuration inside an atom ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
11. Spectral terms of an atom ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
12. Hydrogen molecule: Valence bond method and molecular orbital method ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
13. Homonuclear diatomic molecule and heteronuclear diatomic molecule ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
14. Pi electron system Hückel MO (HMO) method ◆Required preparation: Submission of homework given during the lecture by the prescribed deadline.
15. Overall summary
16. End-of-term exam

[Keywords] operator, Schrödinger equation, perturbation theory, calculus of variation, spectral term, valence bond method, molecular orbital method
[Textbooks and Reference Books] (a) Masayoshi Oiwa ”Basic Quantum Chemistry 2nd edition” (Kagakudojin) ISBN: 4-7598-0176-6, (b) Yoshiya Harada「Basic Chemistry Series 12 Quantum Chemistry」(Shokabou) ISBN: 4-7853-3112-7
[Evaluation] Grade is given in the ratio (assignment)/(final exam) = 1/10. Students who missed 4 or more of the lectures cannot take the end-of-term exam. Make-up test will be conducted only once. However, students whose score less than 35 points in the end-of-term exam cannot take the make-up test. Only a “Pass” will be given for those who take the make-up test. The deadline for submission of homework is 1 pm on Monday following the lecture. Students who cheat willl be punished according to school regulations.
[Related courses] Physics EI : Introduction to Quantum Mechanics

[Course requirements] Students are recommended to complete the course Physics EI Introduction to Quantum Mechanics first. However, this is not a pre-requisite, as the lectures will start with a review of Physics EI Introduction to Quantum Mechanics.
[Remarks] The molecular orbital method is an essential concept to students majoring in chemistry. Although this course is not a required subject of the Department of Applied Chemistry and Biotechnology, it is a strongly recommended course.

有機化学 IV　Organic Chemistry IV
[Instructor] Masami Sakamoto
[Credits] 2
[Semester] 3rd year-Spring-Wed 2
[Course code] T1M123101
[Room] Bldg. ENG-5-204
[Course enrollment] 120
[Candidate] Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description] Following “Organic Chemistry lll”, the nature and basic reaction of organic compounds (carboxylic acids, carboxylic acid derivatives, nitrogen-containing compounds) will be explained.
[Course objectives] Understanding will be intensified on the nature and reactions of carbonyl compounds, carboxylic acids, carboxylic acid derivatives, nitrogen-containing compounds, and heterocyclic compounds through exercises and homework. Furthermore, the students will also understand the interpretation using electronic theory in various reactions, and the symmetry of the orbital.　Not only organic chemical reaction will be simply learned, but also deeper understanding of the mechanism of reaction, even if this reaction is seen for the first time, the student will be able to predict the reaction product by nature of the functional group as aimed in this lecture.
[Plans and Contents] Lectures will be conducted according to the following lesson plan. Replies to topics given out in the previous lesson shall be submitted in advance.
1. Guidance on teaching method, policy
2. Chemistry of carboxylic acids: nomenclature, structure, synthesis and reaction (1)
3. Chemistry of carboxylic acids: synthesis and reaction (2)
4. Chemistry of carboxylic acids: synthesis and reaction (3)
5. Chemistry of carboxylic acid derivatives: nomenclature, structure, synthesis and reaction (1)
6. Chemistry of carboxylic acid derivatives: synthesis and reaction (2)
7. Chemistry of carboxylic acid derivatives: synthesis and reaction (3)
8. Chemistry of amine and its derivatives: nomenclature, nature, reaction (1)
9. Chemistry of amine and its derivatives: reaction (2)
10. Chemistry of amine and its derivatives: reaction (3)
11. Reactivity of substituent group of benzene (1)
12. Reactivity of substituent group of benzene (2)
13. Reactivity of ester enolate (1)
14. Reactivity of ester enolate (2)
15. Achievement check (end-of-term exam) and overall summary

[Keywords] Organic Chemistry,Organic Composition，Organic Reaction,Reaction ｍechanism,nomenclature
[Evaluation]　Comprehension will be determined by the next ratio.　Quizzes (40%), Comprehension Check Test (20%), Final Exams (40%).　Questions in the check comprehension test and final exams will correspond to the content and difficulty of matters that are listed in the goals of this course.　To acquire a credit, take the final exam and check comprehension test, a quiz also serves as attendance as well as the requirement for a total score of at least 60 points that is required.
[Related courses] Organic Chemistry I, Organic Chemistry II, Organic Chemistry III, Stereochemistry, Photochemistry
[Course requirements] Students have preferably taken courses of Organic Chemistry I, Organic Chemistry II, Organic Chemistry III.

生化学 II　Biochemistry II
[Instructor] (Shuichi Kojima)
[Credits] 2
[Semester] 3rd year-Spring-Mon 1
[Course code] T1M124001
[Room] Bldg. ENG-9-107
[Course enrollment] 100
[Candidate] Students in faculty of Engineering .Students have preferably taken courses of Biochemistry I.
[Course description] A lot of chemical reactions occur inside the cell in parallel and in highly coordinated manner.　The students will understand each and all of the steps in basic metabolic pathways, together with how they are organized into the entire metabolic systems. .
[Course objectives]
(General Objective) How various biological molecules are synthesized? How energy is generated, transferred, and utilized in the cell ? Student will be able to explain them at molecule/molecular level.
(Target Achievement) (1) The student will be able to explain how ATP is synthesized and utilized in living systems. (2) The student will be able to explain how the substances that make up the organism, polysaccharides, fats, and nucleic acid are synthesized from low molecular weight compounds. (3) The student will be able to explain how photosynthesis in plants is being performed. (4) The student will be able to explain from a molecular perspective the biological phenomena, the signal transmission and cell cycle and such between intracellular or cell.
[Plans and Contents]
1. Basic concept of metabolism (overview)
2. Glycolysis
3. Glycolytic adjustment and pentose phosphate pathway
4. Glycogen metabolism and gluconeogenesis
5. Citric acid cycle
6. Electron transport chain
7. Oxidative phosphorylation
8. Lipid metabolism
9. Amino acid and nucleotide metabolism
10. Photosynthesis
11. Metabolism and control, overview
12. Signal transmission (Part 1)
13. Signal transmission (Part 2)
14. Cell cycle
15. Apoptosis
16. End-of-term exam

[Keywords] metabolic pathways, biomolecular systems, signal transmission, cellular functions
[Textbooks and Reference Books] The diagrams in the printouts are taken from mainly Vought Basic Biochemistry (3rd Edition) by Tokyo Kagaku Dozin. Use these for reference purposes.
[Evaluation] Over 12times of attendance will be precondition to archive a credit, it will be mainly evaluated by end-of–tern exam, and attendance is also considered.
[Related courses] Biomolecular Chemistry, Biochemistry I
[Course requirements] Students must have taken courses of Biomolecular Chemistry and Biochemistry I.

生体高分子化学　Biological Polymer Chemistry
[Instructor] Masumi Yamada
[Credits] 2
[Semester] 3rd year-Fall-Tues 2
[Course code] T1M125001
[Room] Bldg. ENG-9-107
[Candidate]Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description]　The polymer material is one of the three major indispensable in modern society, in the imitation or replacement polymeric materials of cells in vivo, tissues and organs. This lecture will be about the (1) Structure and function of biological macromolecules and macromolecular fundamentals and (2) Artificial systems that mimic biological functions.
[Course objectives]　The student will understand structure and function of biological macromolecules along with the synthetic polymers that are related to them. (i) The student will be able to explain the function, nature, role, and application of basic biological polymers such as nucleic acids and proteins. (ii) The student will be able to point out the relevance of the structure and function of the polymeric material. (iii) The student will be able to contribute to the development of polymeric materials that have biocompatibility and environmental adaptability.　(iv) The student will be able to utilize biological function to establish the design guidelines of a useful polymeric material.
[Plans and Contents]

1. Fundamentals of biological polymers (1): Chemistry of nucleic acids ◆Required preparation: Revise the contents of the related courses.
2. Fundamentals of biological polymers (2): Chemistry of proteins ◆Required preparation: Read the reference books and prepare for the lecture on proteins.
3. Biological polymer system (1): Analysis of biological information 1 ◆Required preparation: Read the reference books and prepare for the lecture on biological information such as DNA.
4. Biological polymer system (2): Analysis of biological information 2 ◆Required preparation: Read the reference books and prepare for the lecture on biological information such as RNA.
5. Biological polymer system (3): Immunological system ◆Required preparation: Read the reference books and prepare for the lecture on immune system.
6. Biological polymer system (4): Chemistry of extracellular matrix ◆Required preparation: Read the reference books and prepare for the lecture on extracellular matrix.
7. Biological polymer system (5): Cell reprogramming ◆Required preparation: Read the reference books and prepare for the lecture on initialization of cellular information.
8. Use of polymeric materials (1):　Fundamentals of biomedical polymer materials ◆Required preparation: Read the reference books and prepare for the lecture on functions required for biomedical polymers.
9. Use of polymeric materials (2): Biodegradable materials ◆Required preparation: Read the reference books and prepare for the lecture on biodegradable materials.
10. Use of polymeric materials (3): Biocompatible materials 1 ◆Required preparation: Read the reference books and prepare for the lecture on biocompatible materials such as silicone.
11. Use of polymeric materials (4): Biocompatible materials 2 ◆Required preparation: Read the reference books and prepare for the lecture on antithrombotic materials.
12. Use of polymeric materials (5): Polymeric gel materials ◆Required preparation: Read the reference books and prepare for the lecture on Polymeric gel materials.
13. Use of polymeric materials (6): Cell culture materials ◆Required preparation: Read the reference books and prepare for the lecture on cell culture materials.
14. Use of polymeric materials (7): Bioderived materials ◆Required preparation: Read the reference books and prepare for the lecture on Bioderived materials.
15. Overview and end-of-term exam ◆Required preparation: Revise the contents in the 1st – 14th lectures.

[Keywords] Polymer biochemistry, Biomacromolecules, DNA, RNA, Protein, Biofunctional polymer, Biocompatible polymer, Biodegradable polymer
[Textbooks and Reference Books] [Textbook] Handouts, Seitai bunshi no kagaku（Kagaku doujin）, Biomaterial science（Tokyo kagaku doujin）
[Evaluation] Evaluation to be based on exams (70%) as well as mini-tests conducted before the end of the lesson and compulsory reports on topics given (30%).　Late reports will not be accepted except for special reasons. Students should present two thirds or more of lectures, as a general rule. In the event that unfair means is detected, the relevant students will be treated strictly in accordance with the school rules.
[Related courses] Biomolecular Chemistry, Biochemistry I, Biochemistry II, Polymer Chemistry, Polymer synthesis
[Remarks] Students have preferably taken course of Polymer Chemistry.

高分子物性　Physical Chemistry of Macromolecules
[Instructor] Yuji Sasanuma
[Credits] 2
[Semester] 3rd year-Fall-Mon 2
[Course code] T1M126001
[Room] Bldg. ENG-5-105
[Course enrollment]
[Candidate]S tudents of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student. (Credits shall be awarded according to regulations of the faculty and department that the student belongs to.)
[Course description] This lecture is intended for students who have learned the basics of polymer chemistry and desire to more deepen their knowledge of structures and physical properties of polymers.
[Course objectives] The students are expected to comprehend polymers in terms of (1) configuration, (2) conformation, (3) crystal structure, (4) statistical mechanics, (5) solution thermodynamics, (6) crystallization, (7) thermal properties, and (8) mechanical properties.
[Plans and Contents] Tutorial exercises in the textbook will be given as homework for review.
1. Polymeric structure (primary and secondary structures) (conformation, configuration etc.)
2. Polymeric structure (crystalline structure, aggregation structure, etc.)
3. Polymer chain model (1) [molecular chain model] (polymeric model with a chemical bond concept)
4. Polymer chain model (2) [Gaussian chain] (ideal polymeric chain)
5. Dimension and molecular weight of polymer (light scattering, neutron scattering, viscosity measurement, etc.)
6. Flory-Huggins theory (1) [Mixing entropy]
7. Flory-Huggins theory (2) [Mixing enthalpy and □ parameter]
8. Excluded volume effect (characteristics of polymeric solutions)
9. Overall summary of first half lectures, comprehension test
10. Crystallization of polymers (1) [Equilibrium theory]
11. Crystallization of polymers (2) [Kinetics] (Avrami equation)
12. Glass transition (characteristics of thermal properties of polymeric materials)
13. Rubber elasticity (mechanical properties of polymers, entropic elasticity)
14. Mechanical model (1) [Maxwell and Voigt models] (polymer elasticity modelling 1)
15. Mechanical model (2) [four parameter model] (polymer elasticity modelling 2)

[Keywords] Refer to the above-mentioned items in [Course objectives] and [Teaching Contents].
[Textbooks and Reference Books] The students can download the textbook (PDF files) from the WEB page of the KYOSEI 4 Laboratory. Reference Books : P. J. Flory, Principles of Polymer Chemistry, Cornell University Press (1953) or its Japanese edition translated by Shoten Oka and Kisou Kanamaru, Maruzen (1956). Unfortunately, the Japanese edition was already out of print, but, fortunately, some of them are still kept in the Chiba University Library.
[Evaluation] Overall evaluation to be based on summary of first half lectures & comprehension test (40%), end-of-term exam (40%), and tutorial exercises (homework) (20%). The homework report must be submitted in the following lecture
[Related courses]　Physical Chemistry I, Polymer Chemistry, Physical Chemistry III
[Course requirements] Students have preferably take courses of Physical Chemistry I, Physics DI, Polymer Chemistry, and Physical Chemistry III.
[Remarks] Office hour is not specified, but student must take an appointment by email in advance.

有機構造解析 Organic Structure Analysis
[Instructor] Hyuma Masu and Shigeo Kohmoto
[Credits] 2
[Semester] 3rd year-Spring-Mon 2
[Course code] T1M127001
[Room] Bldg. ENG-2-202
[Course description] Knowing the molecular structure of the compound is the most important and fundamental for understanding its physical properties. In this lecture, the students will learn the methodology of identification and structural determination of organic compounds with a wide variety of molecular structures. The basics of various spectroscopies used for the identification of organic compounds are outlined, and the process of the structural determination is explained. Then the students will improve understanding of the process through exercises.
[Course objectives] ◆Objective: The students will be familiar with the basic concepts of spectroscopy and understand the structure determination of organic compounds. ◆Target Achievement: (1) The students understand the relations between the various spectra and the structures of the organic compounds: molecular composition, types of bonds, and functional groups. (2) The students understand the process of the structure determination and can resolve the structure of basic organic compounds by themselves.
[Plans and Contents]
1. Introduction to spectroscopy (electromagnetic wave spectroscopy, quantum mechanics of transition)
2. Ultraviolet/visible light spectroscopy (electronic transition, optical absorption spectrum) ◆Required preparation: Read up on light adsorption and emission in the textbook to prepare for the lesson.
3. Ultraviolet, visible light spectroscopy (chromophore, application) ◆Required preparation: Read up on chromophore, auxochrome in the textbook to prepare for the lesson.
4. Infrared spectroscopy (basic principle and selection law, Fourier transform spectroscopy) ◆Required preparation: Read up on stretching vibration, deformation vibration in the textbook to prepare for the lesson.
5. Infrared spectroscopy (special absorption and spectrum I) ◆Required preparation: Read up on the relationship between functional group and characteristic absorption body in the textbook to prepare for the lesson.
6. Infrared spectroscopy (special absorption and spectrum II) ◆Required preparation: Submit topics related to the 5th lecture and gain a more in-depth understanding.
7. Nuclear magnetic resonance (physical fundamental principle) ◆Required preparation: Read up on how nuclear spin excitation occurs and NMR equation in the textbook to prepare for the lesson
8. Nuclear magnetic resonance (chemical shift, coupling, correlation between structural characteristics and chemical shift) ◆Required preparation: Read up on the reason why different protons or carbon-13s have their own characteristic chemical shifts.
9. Nuclear magnetic resonance (proton nuclear magnetic resonance) ◆Required preparation: Read up on the factors controlling chemical shift in protons and the additive property of chemical shift in the textbook to prepare for the lesson.
10. Nuclear magnetic resonance (carbon 13 nuclear magnetic resonance) ◆Required preparation: Read up on the type of information obtained from carbon 13 nuclear magnetic resonance spectrum in the textbook to prepare for the lesson.
11. Nuclear magnetic resonance (multinuclear NMR, 2-dimensional NMR) ◆Required preparation: Read up on what 2D NMR in the textbook to prepare for the lesson.
12. Nuclear magnetic resonance (tutorial question) ◆Required preparation: Revise 7th to 11th lectures since a tutorial on the structural determination of organic compounds from organic compound protons and carbon 13 NMR spectrum will be conducted.
13. Mass spectroscopy (equipment principle, fragmentation) ◆Required preparation: Read up on the ionization of molecules in the textbook to prepare for the lesson.
14. Mass spectroscopy (various mass spectrometers and concept) ◆Required preparation: Read up on how various mass spectrometers were developed from various problems in the textbook to prepare for the lesson.
15. Tutorial on overall questions ◆Required preparation: Combine all spectroscopy explained so far and revise all the lectures since an overall tutorial on the structural determination of organic compounds will be conducted.
16. End-of-term exam ◆Required preparation: Revise all previous lectures since questions on the basics of spectroscopy and the structural determination of compounds formed from a combination of the spectrum of organic compounds will be posed.

[Keywords] The identification method of the organic compound,ultraviolet-visible spectroscopy, the nuclear magnetic resonance method, mass spectrometry
[Evaluation] Comprehension will be determined by the next ratio. Short test also serves as attendance (30%), reports (20%), and final exams (50%). The deadline of the reports is the next lecture, as a general rule. The score of the

late-submitted reports will be deducted. Final exam will correspond to the content and difficulty of matters that are listed in the goals of this course. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.

分析化学 II　Analytical Chemistry II
[Instructor] Masanori Fujinami
[Credits] 2
[Semester] 2nd year-Fall-Fri 4
[Course code] T1M128101
[Room] Bldg. ENG-5-204
[Course enrollment] 100
[Candidate] Students of faculty of Engineering.
[Course description] In “Analytical Chemistry l and ll”, the student will learn the analysis based on equilibrium capacity, electrochemical analysis, the molecular and atomic spectrum of light, separation analysis, and biochemical analysis.
[Course objectives] While being aware of the important separation and detection in analytical chemistry, the student will be able to discuss the methodology.　In separation, because of the principle and biochemical analysis for manifestation of the strategy of liquid-liquid extraction, the strategy of separation during difficult separations shall be described.　The student will be able to debate on the oxidation-reduction reaction in terms of its electron transfer.
[Plans and Contents] Prepare the viewgraphs used in the lectures for download. Contribute to the understanding of the contents.
1. Oxidation-reduction reaction and potential
2. Oxidation reduction titration◆Go through the topics given in the first lecture.
3. Battery and electron transfe　◆Go through the topics given in the second lecture.
4. Separation analysis (precipitation reaction)　◆Go through the topics given in the third lecture.
5. Separation analysis (extraction, distribution) 1　◆Go through the topics given in the 4th lecture.
6. Separation analysis (extraction, distribution) 2　◆Go through the topics given in the 5th lecture.
7. Multi-stage extraction　◆Go through the topics given in the 6th lecture.
8. Summary of separation　◆Make basic items concrete.
9. Basics of gas chromatography　◆Go through the topics given in the 8th lecture.
10. Gas chromatography　◆Go through the topics given in the 9th lecture.
11. Liquid chromatography　◆Go through the topics given in the 10th lecture.
12. Other chromatography　◆Go through the topics given in the 11th lecture.
13. Electrophoresis for DNA and protein analysis　◆Go through the topics given in the 12th lecture.
14. Analytical methods using enzymatic reaction　◆Go through the topics given in the 13th lecture.
15. Immunity analysis　◆Go through the topics given in the 14th lecture.

[Keywords] Separation, extraction, chromatography, analysis of immunity, electrophoretic analysis, enzymatic reaction
[Evaluation] The goal of this class is to conduct the mid-term exams and finals exams to be able to verify minimal acquisition of learning, by exceeding the standard points, the student would be able to acquire a credit which is the necessary condition.　The performance evaluation regarding the person to acquire the credit will be by the total points of every quiz. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Analytical Chemistry I,　Experiment in Analytical Chemistry
[Course requirements] Students must have taken courses of Analytical Chemistry I, Experiment in Analytical Chemistry.
[Remarks] There is no particular need to learn prior knowledge about the student of the lecture.

表面計測化学 Advanced Surface Analysis
[Instructor] Masanori Fujinami
[Credits] 2
[Semester] 3rd year-Fall-Fri 2
[Course code] T1M128201
[Room] Bldg. ENG-5-204
[Course enrollment] 60
[Course description] Following “Analytical Chemistry l and ll”, this course is the third lecture series relating analytical chemistry for deriving substance information. Although analysis methods for liquid sample were taken up in previous two courses, in this course, basically, we will think on how to analyze the samples that are solid. Therefore, the chemical composition analysis method using X-ray, □-ray, infrared light, electrons, ions and positrons will be lectured. This methodology is essential for developing materials, and it is extremely important for future material research to know the principle and applications.
[Course objectives] Understand the interaction between solid materials and X-ray, □-ray, infrared light, electrons, ions and positrons, to be able to discuss the principles and equipment of surface composition analysis methods using these beams or lights. Also, the student will learn the vacuum technology as one of the component key technologies, to be able to prepare to apply the knowledge. In addition to this year, the student will also learn about biochemical analysis.
[Plans and Contents]
1. Importance of surface and local analysis
2. Factors affecting vacuum ◆Go through the topics given in the first lecture.
3. Vacuum pump and measurement method ◆Go through the topics given in the second lecture.
4. Interaction between infrared rays and solids ◆Go through the topics given in the third lecture.
5. Surface analysis using infrared rays ◆Go through the topics given in the 4th lecture.
6. Interaction between x-rays and solids (fluorescent X-ray analysis) ◆Go through the topics given in the 5th lecture.
7. X-ray electron spectroscopy ◆Go through the topics given in the 6th lecture.
8. Interaction of electrons and solids (scanning electron microscope) ◆Go through the topics given in the 7th lecture.
9. Auger electronc spectroscopy ◆Go through the topics given in the 8th lecture.
10. Interaction between ions and solids ◆Go through the topics given in the 9th lecture.
11. Rutherford backscattering spectroscopy ◆Go through the topics given in the 10th lecture.
12. Secondary ion mass spectroscopy ◆Go through the topics given in the 11th lecture.
13. Interaction between positrons and solids (positron annihilation method) ◆Go through the topics given in the 12th lecture.
14. Laser spectroscopy ◆Go through the topics given in the 13th lecture.
15. Scanning tunnelling microscope ◆Go through the topics given in the14th lecture.

[Keywords] X-ray, ion, electron, positron, the solid surface
[Textbooks and Reference Books] There is nothing in particular. To be able to download the viewgraph to be used in this lecture, and to contribute to the understanding of the content.
[Evaluation] The required condition on acquisition of credits is by exceeding the standard points in taking the mid-term exams and final exams that is to verify satisfaction of items that meet the minimum. Evaluation of acquisition of credits is by every short test. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Analytical Chemistry I, Analytical Chemistry II, Experiment in Analytical Chemistry
[Course requirements] There is no particular need to learn prior knowledge about the student of the lecture.

反応工学 Chemical Reaction Engineering
[Instructor] Satoshi Sato
[Credits] 2
[Semester] 3rd year-Spring-Tues 1
[Course code] T1M129001
[Room] Bldg. ENG-5-204
[Course enrollment] 80
[Candidate] Specially Registered Non-Degree Student may take this course
[Course description] The lecture will be about the fundamentals needed to design a reactor. The explanation will be about reaction kinetics in homogeneous reaction system and reaction kinetics in heterogeneous reaction system.
[Course objectives] From the perspective of chemical engineering, students will revise the contents of reaction kinetics that was studied in Physical Chemistry ll. Then students will understand the fundamentals required for the reactor design, and deepen their understanding on the distinction between the kinetics in a heterogeneous reaction system and reaction kinetics in homogeneous reaction system. As goals and objectives, the student will understand correctly (1) the differences in the rate equation for the reactors in homogeneous reaction system, and (2) the diffusion-controlled reactions and the rate-limiting reactions in a heterogeneous system.
[Plans and Contents] Lessons on [Chapter 1] Practical calculation of equilibrium composition, [Chapter 2] Reaction rate in homogeneous reaction system, [Chapter 3] Reaction rate in heterogeneous reaction system and [Chapter 4] Reaction equipment.

1. [Chapter 1] Practical calculation of equilibrium composition: Heat of reaction, equilibrium constant ◆Required preparation: Prepare the specified textbooks, and pp. 154-156 on Chapter 5.
2. Equilibrium conversion ratio, approximate calculation of equilibrium composition ◆Required preparation: Revise the scope indicated in the first lecture.
3. Equilibrium of complex reaction ◆Required preparation: Answer the tutorial questions given in the second lesson.
4. [Chapter 2] Reaction rate in homogeneous reaction system: Reaction rate equation, first mini-test ◆Required preparation: Revise the lesson scope in the1st to 3rd lectures.
5. Flow model of reaction fluid, reaction rate analysis ◆Required preparation: Revise the scope given in the 4th lesson.
6. Continuous flow-through reactor ◆Required preparation: Answer the tutorial questions given in the 5th lesson.
7. Reaction rate analysis of complex reactions ◆Required preparation: Answer the tutorial questions given in the 6th lesson.
8. [Chapter 3] Reaction rate in heterogeneous reaction system: Film diffusion resistance, 2nd mini-test ◆Required preparation: Revise the scope of the 4th–7th lessons.
9. Absorption equilibrium and absorption rate equation ◆Required preparation: Revise the scope given in the 8th lesson.
10. L-H type catalytic reaction rate equation ◆Required preparation: Answer the tutorial questions given in the 9th lesson.
11. Solid intraparticle diffusion and catalytic effectiveness factor ◆Required preparation: Revise the scope given in the 10th lesson.
12. Reaction rate of solid-phase reaction ◆Required preparation: Answer the tutorial questions given in the 11th lesson.
13. [Chapter 4] Reaction equipment: Reaction operation design, 3rd mini-test ◆Required preparation: Revise the scope of the 8th–12th lessons.
14. Interaction between fixed bed and fluidized bed ◆Required preparation: Revise the scope given in the 13th lesson .
15. Comprehension test and supplementary explanation ◆Required preparation: Revise the lesson scope of Chapter 5 in the textbook

[Keywords] Homogeneous reactions, Heterogeneous reactions, Reaction kinetics, Apparatus for chemical reactions.
[Textbook] 「Basics of Chemical Engineering, Applied Chemistry Series 4, Asakura Publisher,
[Evaluation] Reports on specified tutorial questions are required to be submitted as extracurricular studies. Evaluation is given by short test (3 times) (20%), end-of-term exam (80%).
Both in short test and end-of-term exam will have a full score of 100 points and will correspond to the content and difficulty of matters that are listed in the goals of this course. To acquire credits, take all the end-of-term exam and short tests, for a total score of at least 60 points that is required.
[Related courses] Physical Chemistry I, Physical Chemistry II
[Course requirements] Attendance of more than 4/5 is requisite.

環境適合無機材料 Inorganic Materials
[Instructor] Naofumi Uekawa
[Credits] 2
[Semester]3rd year-Fall-Fri 1
[Course code] T1M130001
[Room] Bldg. ENG-5-104
[Course enrollment] 110
[Candidate] Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description] This lecture is for the student to understand the relationship between the inorganic material and the environment, theoretically and visually, while showing sample in the slide. In addition, there will be explanations on advanced topics included on the existence and use of inorganic material, material environmental cleanup in the research and industry.
[Course objectives] This lecture aims for the student to understand the synthesis and production method regarding the variety of inorganic materials that are used in modern society, they will also understand the impact that these processes give the environment and can chemically consider methods such as reducing the environmental impact. In order to achieve this goal, the aim is for better understanding of the following points so that the student can better understand functional inorganic materials also closely related with the environment, such as environmental cleanup. (1) The student will be able to explain from the thermodynamic point of view regarding the adsorption on a solid surface. (2) The student can explain about adsorption isotherms of BET adsorption isotherm of Langmuir that is in the typical adsorption isotherm. Then the student can also use this for analysis of the actual experiment data. (3) The student will be able to explain the manufacturing method of the activated carbon and features. (4) The student will be able to describe the relationship on the structures and properties of zeolite and clay mineral. (5) Has the understanding of the principles of the photo catalyst. (6) Understands regarding the typical synthesis method (vapor-phase and liquid-phase solid-phase).
[Plans and Contents]
1. Introduction Boundary surface and environmentally friendly inorganic materials
2. Boundary and surface, Understanding on nanoscale 1 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
3. Boundary and surface, Understanding on nanoscale 2 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
4. Thermodynamics of boundary and surfaces ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
5. . Adsorption theory 1 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
6. Adsorption theory 2 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
7. Analysis of adsorption experiment data ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
8. Environmental purification materials 1 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
9. Environmental purification materials 2 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
10. Environmental purification materials 3 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
11. Environmental purification materials 4 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
12. Environmental purification materials 5 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
13. Inorganic chemical reactions and environment 1 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
14. Inorganic chemical reactions and environment 2 ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
15. Overall revision and comprehension test ◆Check and organize the distributed materials. Check the points in the next lesson that are hard to understand prior to the lecture.
16. Explanation of comprehension test

[Keywords] Minerals, Activated carbon, Chemistry of silicates, Zeolites, Photocatalysts
[Textbooks and Reference Books] Reference book: Basics of Colloid Chemistry (Koudabsha) Fumio Kitahara.

[Evaluation] Mainly, evaluated based on the scores of the understanding level tests, and the score of the reports within the lecture (about 5 times in all) is considered.
[Related courses] Inorganic Chemistry II
[Remarks] The lectures will be conducted using mainly distributed materials. Students are to make their own preparations for the lessons by checking out the areas in the printouts that they find difficult to understand prior to the lectures.

特許法概論　Introduction of Patent Law
[Instructor] (Hiroyuki Kurihara)
[Credits] 2
[Semester] 3rd year-Spring-Thurs 2
[Course code] T1M131001
[Room] Bldg. ENG-2-202
[Course description] This lecture will focus on the basic knowledge about intellectual property rights, especially patent laws, and basic analysis of intellectual property right system of each country.
[Course objectives] The explanation will be about the knowledge on intellectual property rights especially for patent law that is necessary outside the community of undergraduates.　While touching the background of the so-called pro-patent era, we will incorporate much information about intellectual property activities in the enterprise.　Then, since international relationship is also important, there will also be some basic instructions of intellectual property right system of each country. With the aim to understand the intellectual property rights after the lecture is over, the student will be able to understand things based on the perspective of the actual ownership.　Furthermore, the student will also be able to investigate on the patent.
[Plans and Contents] Lectures are conducted based on printouts. Students are to check up on terms used in each lecture topic before attending the lesson and go through the distributed materials again after the lecture to check if there any points that they are not clear about.
1. Intellectual property system [patents, utility model, design, trademark, copyrights, Unfair Competition Prevention Law]
2. Objective and structure of patent system
3. Procedure from patent application to patent award
4. Inventions that can be patented, patentability assessment 1
5. Inventions that can be patented, patentability assessment　2
6. Reading of official bulletins, public inventions – infringement of rights, technical scope
7. Patent investigation, use of patents
8. Use of intellectual property and corporate initiatives, readiness of research staff
9. Utility models, designs, trademarks, copyrights
10. Foreign applications 1
11. Foreign applications 2
12. From invention to patent application
13. Procedure from patent application to being patented
14. Implementation of invention and rights infringement
15. Summary of patent law, end-of-term exam

[Keywords] patent, utility model, design, trademark, copyright
[Textbooks and Reference Books] Handouts provided in every lecture
[Evaluation] Evaluated on attendance and exams. Attendance 40points, Exams 60 points. On the exams, checking understanding of property rights and patent law.
[Remarks] 4th year students of Department of Nanoscience may take this course.

物理化学 III　Physical Chemistry III
[Instructor] Yuji Sasanuma
[Credits] 2
[Semester] 3rd year-Spring-Mon 5
[Course code] T1M133001
[Room] Bldg. ENG-5-204
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student. (Credits shall be awarded according to regulations of the faculty and department that the student belongs to.)
[Course description] The lecture will deal with fundamentals of equilibrium statistical thermodynamics of micro-canonical, canonical, and grand canonical ensemble systems.
[Course objectives] The students are expected to comprehend the molecular thermodynamics theory and the relationships between quantum mechanics and classical thermodynamics by way of the partition function.
[Plans and Contents] We will lecture with Atkins' textbook of physical chemistry (chapters 13, 16, and 17). After learning the basic concepts of statistical mechanics (chapter 16), the students will deepen their knowledge of molecular motions (chapter 13) and advance to molecular thermodynamics (chapter 17).

1. Distribution of energy levels (1) (Boltzmann distribution)
2. Distribution of energy levels (2) (partition function)
3. Internal energy
4. Statistical entropy
5. Canonical ensemble (partition function and thermodynamic function)
6. Summary of first half and comprehension check
7. Fundamentals of quantum mechanics
8. Rotational motion of molecules
9. Vibrational motion of molecules
10. Applications of statistical thermodynamics (average energy)
11. Heat capacity and equation of state
12. Interpretation of equilibrium constant in terms of statistical mechanics
13. Grand canonical ensemble (chemical potential)
14. Proof of Gibbs' phase rule
15. Statistical mechanics and computational chemistry (basics of molecular dynamics)

[Keywords] Boltzmann distribution，partition function，internal energy，statistical entropy，molecular partition function，translational-rotational-vibrational motions，equilibrium constant，chemical potential
[Textbooks and Reference Books] Peter Atkins and Julio de Paula, Physical Chemistry, 8th Edition, Oxford University Press (2006) or its Japanese edition published by Tokyo Kagaku Dojin (2009); Yosuke Nagaoka, Statistical Mechanics, Iwanami-Shoten, Tokyo (1994).
[Evaluation] Evaluation shall be based on summary of first half and comprehension check (40%), end-of-term exam (40%), and exercises (homework) (20%). The homework report must be submitted in the following lecture.
[Related courses]　Physical Chemistry I, Physics DI, Physics DI Exercise, Physics EI
[Course requirements] Students have preferably taken courses of Mathematics of General Education, Physical Chemistry I, Physics DI, Physics DI Exercise, and Physics EI.
[Remarks] Statistical thermodynamics is an interpretation of macroscopic classical thermodynamics at the molecular level, thus being inevitable for the precise understanding of chemical phenomena. Therefore, chemistry students are strongly recommended to take this course.　Office hour is not specified, but student must take an appointment by email in advance.

触媒化学　Chemistry of Catalysis
[Instructor] Satoshi Sato
[Credits] 2
[Semester] 3rd year-Spring-Tues 2
[Course code] T1M134001
[Room] Bldg. ENG-5-204
[Course enrollment] 130
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] In chemistry, although creativity of reaction of new materials and new production of the substance are the most important, here, the “catalyst” plays an immeasurably major role.　There are various catalysts used in production processes or environmental maintenance, electrical products and such of chemical products of fuel, food, clothing, gasoline, plastics and such necessary in our daily life.　Then, enzyme called “catalyst” supports our life itself; catalysis is essential for the maintenance of life.　Based on the above, in this discussion “catalyst” in detail with specific examples will be discussed.
[Course objectives] In a limited spaceship earth, the importance of science of conversion of resources related material, energy, environment and bio has been rediscovered.　In this lecture we will intensify the understanding regarding the nature and role of “catalyst” as the key to creating a new drama for chemical reaction, the lecture will focus on the mechanism structure and physical properties in the field of catalysis, and we will also discuss the multi-faceted nature and influence of science and nature.
Teaching Plans and Teaching Contents]
1. Preface of catalyst chemisty: Revise and understand the definition of a catalyst
2. Physical adsorption and chemical adsorption Revise and understand the respective characteristics.
3. Monomolecular layer adsorption: Revise Langmuir adsorption model
4. Multimolecular layer adsorption: Revise and understand the theory behind the BET adsorption model well.
5. Heterogeneous catalytic reaction: Revise potential energy in particular.
6. Langmuir-Hinshelwood mechanism and Rideal-Eley mechanism: Revise the differences between the respective mechanisms.
7. Homogeneous catalytic reactions: Revise examples of reactions using complex, and examples of reactions in enzymes etc.
8. Characterization of catalysts: Revise specific examples using surface analyzers
9. Design and manufacture of catalysts: Revise specific examples on the manufacture of superior catalysts
10. Basic properties and catalytic performance: Revise the relationship between the electron structure, geometric structure and catalytic performance
11. Metallic catalysts: Revise the reactions of typical metal catalysts
12. Metallic oxide catalysts: Revise the reactions of typical metallic oxide catalysts
13. Acid-based catalysts: Revise the reactions of typical acid-base catalysts
14. Catalyst design: Understand the process of creating superior catalysts
15. Summary, test
16. Revision of important items: Overall revision

[Keywords] Adsorption, Catalytic property, Chemical reaction rate, Selectivity, Catalyst life, Catalytically active sites, Active intermediate, Surface area, Pores.
[Textbook] [New Chemistry in Catalysis, written by H. Hattori et. al., Sankyo Publisher]
[Evaluation] Evaluated by short tests and assignments 30%, interim exams and final exams.70%.
[Course requirements] Students have preferably taken courses of Physical Chemistry I and II.

立体化学　Stereochemistry
[Instructor] Motohiro Akazome
[Credits] 2
[Semester] 3rd year-Fall-Tues 3
[Course code] T1M135001
[Room] Bldg. ENG-5-204
[Course description] Understanding of organic chemistry in 3 dimensions is extremely important.　This lecture explains the organic chemistry of the reaction mechanism and stereochemistry with emphasis on the 3 dimension of reaction, intermediates and transition state structures of organic molecules.　Give out assignments related to issues discussed in every class and sufficient self-study is required.　Then, the assignments will be explained in the next lecture.　Being able to verify if the student's analysis is correct is extremely effective.
[Course objectives] The function of organic molecules and other biological molecules is manifested by the three-dimensional 3-dimension structure.　Therefore, understand the stereochemistry of organic compounds, control on a high degree, and to construct, would be one of the major objectives of organic chemistry.　(General) Objective: After learning organic chemistry l-lV, revert the organic chemistry from the stereochemistry to have a better understanding of organic chemistry.　(Target) Achievement: (1) The student will be able to explain the reaction mechanism and stereochemistry with the transition state structure and reaction intermediates of organic molecules.　(2) The student will be able to analyze what organic reaction is used from synthetic route of natural products and pharmaceuticals.　(3) The challenge of learning outside the classroom is obtained by arranging the issue of major universities graduate school entrance examination, by working enthusiastically, the problem of review and graduate admission of Organic Chemistry l-lV would be solved about 60% aiming for acquisition of application force.　(4) The student will be able to write the stereochemistry of molecular structure and the reaction mechanism controlling the stereochemistry.
[Plans and Contents] The following will be taught with a special focus on molecular structure, stereochemistry and reaction selectivity based on the things learned in Organic Chemistry I-IV. In particular, in the Vollhardt & Schore textbook and Organic Chemistry I–IV, stereochemistry is covered only at a minimum level due to its complexity. Therefore students have to supplement the areas that they are lacking in and acquire an understanding of the concept of stereochemistry. New information and explanations related to the areas covered each week shall be explained and questions selected from the graduate school entrance exams shall be given as homework. In the subsequent lessons, the students' level of understanding shall be checked by getting them to explain these topics themselves. For topics outside of the curriculum, look at the questions alone and try to answer them first. If you can't understand the question, refer to the textbook and reference books listed in the Remarks column to try to answer them.

1. Stereochemistry and optical activity:　Check RS notation based the Cahn-Ingold-Prelog precedence rule and understanding of diastereomer and mirror-image isomers caused by asymmetric carbon atoms. Teach the chirality of asymmetric carbon atoms. ◆Extracurricular studies: Write a report on Topic 1 (distributed on the actual day) as a tutorial question.
2. Conformation and conformational energy: Check understanding of conformer and conformational energy, Gauche repulsion and 1,3-diaxial repulsion. Cite the structure of cyclohexanes and teach what the A-value, 1,3-allyl strain and anomeric effect mean. ◆Extracurricular studies: Write a report on Topic 2 (distributed on the actual day) as a tutorial question.
3. Stereochemistry of nucleophilic substitution reaction: Check the understanding of stereochemistry and reaction mechanism between the SN1 and SN2 reactions. Learn how to determine the enantiomeric excess rate, reaction mechanism and Walden inversion based on the definition and calculation of specific rotation. ◆Extracurricular studies: Write a report on Topic 3 (distributed on the actual day) as a tutorial question.
4. Stereochemistry of elimination reaction: Check the understanding of stereochemistry and the reaction mechanism between the E1 and E2 reactions. Learn how to predict the product obtained from the relationship between a conformer and anti-periplanar arrangement. Teach the importance of conformation in Hofmann elimination. ◆Extracurricular studies: Write a report on Topic 4 (distributed on the actual day) as a tutorial question.
5. Addition reaction towards alkenes: Check the understanding on the reactions towards alkenes and reaction regioselectivity. Teach hydroboration and carbene reactions towards a double bond. ◆Extracurricular studies: Write a report on Topic 5 (distributed on the actual day) as a tutorial question.
6. Syntheses and reactions of epoxides: Check the understanding on the synthesis and reaction regioselectivity of epoxides. ◆Extracurricular studies: Write a report on Topic 6 (distributed on the actual day) as a tutorial question.
7. Stereochemistry of addition reactions towards carbonyl compounds: Teach stereoselective addition reactions using the Felkin-Anh model. Teach the reaction mechanism of the Z-selectivity in the Wittig reaction and E-selectivity in the Horner-Wasworth-Emmons reaction in the alkene syntheses. ◆Extracurricular studies: Write a report on Topic 7 (distributed on the actual day) as a tutorial question.

8. Reaction on α-position of carbonyl compounds and the stereochemistry: Teach the regioselective formation of enols using cyclohexanones as an example. Explain the Zimmerman-Traxler transition state that is important in aldol reactions and teach assymetric aldol reactions. ◆Extracurricular studies: Write a report on Topic 8 (distributed on the actual day) as a tutorial question.
9. Diels-Alder reaction and pericyclic reation: Check the understanding on the endo rule and HOMO-LUMO relationship of the Diels-Alder reaction. Teach what a pericycle reaction is. ◆Extracurricular studies: Write a report on Topic 9 (distributed on the actual day) as a tutorial question.
10. neighboring-group participation and intramolecular reaction: Cite reactions assisted by neighboring-group participation and teach the stereochemistry of products formed. Cite a rearrangement reaction as an intramolecular reaction and teach stereochemistry. ◆Extracurricular studies: Write a report on Topic 10 (distributed on the actual day) as a tutorial question.
11. Amine and stereoselective syntheses: Check the stereoinversion of amines and teach the relationship between the structure and stereoinversion energy. ◆Extracurricular studies: Write a report on Topic 11 (distributed on the actual day) as a tutorial question.
12. Kinetic control and thermodynamic control: Teach the commonality of reaction coordinates using examples with differing products that are formed from kinetic control and thermodynamic control. ■Extracurricular studies: Write a report on Topic 12 (distributed on the actual day) as a tutorial question.
13. Explain assignment 12 and areas that could not be covered in the previous items.
14. Revision and end-of-term exam: Review the series of lectures and check again the importance of stereochemistry in organic chemistry.
15. Explanation of end-of-term exam and overall summary: Explain the problems took up in exams and also explain items that are often mistaken and items that students are often weak. Summarize this lecture course of stereochemistry.

[Keywords] Asymmetric carbon, Chirality, Steric structure, Racemization and optical resolution, Reaction mechanism, Molecular orbital and stereochemistry, Chiral auxiliary and stereochemistry, Natural-product synthesis and retrosynthetic analysis

[Textbooks and Reference Books] Textbook:"Vollhardt & Schore Organic Chemistry (Part 1 & 2), the sixth edition by Kagaku Dozin. Reference Books:"Warren's Organic Chemistry (Vol. 1 & 2) by Tokyo Kagaku Dozin

[Evaluation] Overall determination in the percentage of 30% in handling of challenges and 70% of examinations. Understanding will be confirmed in percentage of ability to explain organic reactions stereochemistry and reaction mechanics 40%, ability to apply retrosynthetic analysis of natural products and pharmaceuticals 50%, on matters concerning the typical stereochemistry of handling 70 problems in items and report assignment covered in class. In the challenge, the students will be evaluated on how they actively handled their work such as spending significant amount of time learning, and will write their own 3 dimensional structure and reaction mechanism, if there are items that are not understood, the textbook is to be referred to. The submission of the report assignments shall be after the self-assessment in class. To be able to acquire a credit, the overall evaluation of the exams and assignments should be at least 60%.

[Related courses] Organic Chemistry I- Organic Chemistry IV

[Course requirements] To understand this lecture, it is minimum required for students to have taken courses of Organic Chemistry I- Organic Chemistry IV, and earn the credits .

[Remarks]

◆ Most of the students spend about two hours to prepare each report. Two hours of extracurricular studies is one of the prerequisites for every course to acquire a credit, as a general rule.

◆"Vollhardt & Schore Organic Chemistry (Part 1 & 2), the sixth edition" is also the textbook for organic chemistry I–IV, with the course covering up to the Chapter 23.

◆ For those with more advanced learning needs, please use "Warren's Organic Chemistry (Vol. 1 & 2) by Tokyo Kagaku Dozin" as a reference book. Students who understand Vollhardt & Schore's textbook may learn about advanced stereochemistry and details at a higher level for developmental purposes. This can also be used in lexically. However, those with insufficient understanding may find it confusing and hard to digest.

■ Students with insufficient understanding have to make sure they read the teaching unit related to the Vollhardt & Schore's textbook once before every lesson and endeavour to revise Organic Chemistry I–IV.

光化学 Photochemistry
[Instructor] Masami Sakamoto
[Credits] 2
[Semester] 3rd year-Fall-Fri 3
[Course code] T1M136001
[Room] Bldg. ENG-5-204
[Course enrollment] 120
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] Simple explanation of the nature and behavior of excited molecules. Detailed explanation of reactions of ground and excited states of aromatic compounds and such especially alkenes and carbonyl compounds. Explanation on photoreaction and its own surroundings of typical organic compounds especially the latest optical technology.
[Course objectives] Along with intensifying the understanding of the basic issues of the differences of reactivity of excited molecule and molecule of the ground state, the student will also learn up to the industrial technology of optical light from the reaction in nature. Aims for deeper understanding of the basic excited state and energy deactivation process, and examples and reaction mechanism of the typical organic photochemical reactions.
[Plans and Contents] Lectures will be conducted according to the following lesson plan. Answers to topics given in the previous lesson are to be prepared in advance.

1. Basics of photo-chemical reactions and photoreactive characteristics
2. Electron excitation and deactivation processes
3. Properties of excited molecules
4. Woodward-Hoffmann rule
5. Photoelectron transfer reaction
6. Electronic energy transfer
7. Photochemistry of carbonyl compounds
8. Photochemistry of alkenes and alkynes
9. Photochemistry of aromatic compounds
10. Photochemistry of polyenes, conjugated and unsaturated carbonyl compounds
11. Properties and reactions of singlet oxygen
12. Chemoiluminescence and photochemistry in the natural world
13. Photochromism, principle of lasers and industrial applications
14. Experimental methods for photocatalysts and photochemistry
15. End-of-term exam, latest optical technologies, overall summary

[Keywords] Photochemistry, excited state, ground state, light energy, organic chemistry, light technology
[Evaluation] Comprehensive determinations shall be according to the next general percentage. Quizzes (40%), Comprehensive Check Test (20%), Final Exams (40%) The questions in the comprehensive test and final exams will be regarding the difficulty and contents equivalent to the items listed in the target achievement of this course. In order to acquire credits, take the final exam and comprehensive check test, then, the quizzes together with the attendance including the overall points of at least 60 points are required.
[Related courses] Organic Chemistry I-IV, Stereochemistry
[Course requirements] Students have preferably understood basic of organic chemistry.

分子生物学入門　Molecular Biology
[Instructor] (Taiichi Sakamoto)
[Credits] 2
[Semester] 3rd year-Fall-Tues 5
[Code Number T1M137001
[Room] Bldg.ENG-2-202, Bldg.ENG-5-104 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 100
[Candidate]Students of faculty of Engineering.This course is targeted at students in the materials and chemicals groups who are studying the molecular science of elementary processes in intracellular reactions in biochemistry.
[Course description] Biological studies are now conducted on the molecular level. In this lecture, the important concepts and topics in modern molecular biology shall be given in molecular language.
[Course objectives]
(General Goal) The student will be able to understand the behavior of organisms in units of individuals or species in molecular terms, and that how the modern molecular biology has changed our view of the world and has innovated (or will be able to innovate) our life.
(Target Achievement)
(1) Understand the molecular mechanisms of the expression of genetic information.　(2) Understand at molecular level about important life phenomena such as transposon, virus and cancer etc. (3) Understand the fundamentals of basic genetic manipulation based on molecular biology.
[Plans and Contents] A total of 15 lectures will be conducted (16 including the end-of-term exam). Basically, the lectures will be conducted using Powerpoint presentations and supplemented by additional printouts to make them more visually appealing where necessary. Note-taking is strongly recommended during the lectures. Three tutorials will be given for revision purposes and submission of all three is a pre-requisite for taking the end-of-term exam. The basic concept of molecular biology will be explained in the first half (1st–9th lectures) while the important life phenomena at the molecular level will be explained over the next four lectures (10th-13th lectures). In the last two lectures (14th and 15th lectures), basic genetic manipulation will be introduced. Through these lectures, students will get to understand the essence and appeal of molecular biology and get in touch with advanced bioscience.
1. Orientation and flow of genetic information (central dogma)
2. DNA reproduction 1 (DNA structure and historical experiments)
3. DNA reproduction 2 (DNA polymerase and reproduction mechanism)
4. Transcription 1 (RNA polymerase and transcription mechanism)
5. Transcription 2 (transcription control)
6. Post-transcription processing
7. Translation 1 (translation mechanism)
8. Translation 2 (translation control)
9. Localization of proteins and quality control
10. Molecular biology of virus
11. Molecular biology of cellular signal transduction
12. Genomics and system biology
13. Non-coding RNA molecular biology
14. Basics of genetic operations 1 (genetic cloning)
15. Basics of genetic operations 2 (protein production)
16. End-of-term exam

[Keywords] genetic information and evolution，recombinant DNA technologies, post-genome
[Textbooks and Reference Books] Basic Chemistry Series, Biological Science II, Kimitsuna Aatanabe et al (Maruzen)
[Evaluation] An attendance of at least 12 lectures is a pre-requisite. End-of-term exam shall be conducted. Scoring will be based on tutorials collected during lessons (40 points) and the end-of-term exam (60 points). A correct understanding of the basic concept of molecular biology is a standard requirement.
[Related courses] Biomolecular Chemistry, Biochemistry I, Biochemistry II

生物化学工学　Biochemical Engineering
[Instructor] Minoru Seki
[Credits] 2
[Semester] 3rd year-Fall-Mon 4
[Course code] T1M138001
[Room] Bldg. ENG-2-202, Bldg. GEN -D-51 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] about 80
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] The student will learn the necessary fundamental idea to understand the reaction systems relating organisms/enzymes and the related technologies such as basic research on biochemistry, cytotechnology and biomedical engineering and so on, industrial production of pharmaceuticals or foods etc., green processes, environmental biotechnology about wastewater/waste treatments, assessment/analysis of ecological systems and global environment etc.　This course aims to teach the basic idea for engineering (quantitative) handling of biological reactions or biological processes.　If the students have already understood the fundamental matters regarding biomolecules and organisms to be studied in "Biochemistry l" and "Biochemistry ll", this course would be rather easy. However, also considering the students in this lecture who didn't take these courses, they can also learn the fundamental matters in biological reactions.　If the students have understood the quantitative treatment of the chemical reaction rate, e.g., the course contents of "Physical Chemistry ll", "Chemical Reaction Engineering" and "Fundamentals in Chemical Engineering", that would deepen understanding in this lecture.　Even if the students have not taken above-mentioned courses, they would take minimum understanding with the exertion of effort.
[Course objectives]
(Objective) The student must understand the basic idea concerning analysis, design, measurement and control of biological reaction systems based on the kinetic concept targeting biochemical and biological reaction process (bioreactor) and the separation process of bio-products (bio-separation).
(Target Achievement)
(1) Understand the nature of the enzyme, and characteristics of the enzymatic reaction, to be able to explain.
(2) The student will understand the enzymatic reaction rate equation to be able to derive the rate equation.
(3) The student must be able to explain mechanisms and factors that can affect the enzymatic reaction rate.
(4) The student must understand how the enzymatic reaction has been applied to be able to explain.
(5) The student must understand the nature of the cell as a catalyst to be able to explain including its applications.
(6) The student must understand the concept of modeling the cell proliferation and the metabolic reactions to be able to explain.
(7) The student must be able to conduct a quantitative estimation of the cell proliferation.
(8) The student must be able to explain kinetically, the culture and metabolite production of the cell.
(9) The student must be able to understand the transport processes in bioreaction system, especially the importance of oxygen transfer, to be able to explain them quantitatively.
(10) The student must understand the type and operation methods of the biological reaction system to be able to explain.
(11) The student must understand the characteristics of the measurement and control technologies of biological reaction systems to be able to explain.
(12) The student must understand the characteristics of the separation process of bioproducts to be able to explain.
(13) The student must understand the concept for evaluation of the cost of bioprocess to be able to explain.
[Plans and Contents] Students are required to gain a more in-depth understanding through practical tutorials, quizzes, reports etc. where necessary in addition to the normal lectures. Printouts summarizing the lecture contents will be distributed. The number of lectures in the first half may be increased taking into consideration the level of understanding in order to emphasize understanding of the contents in the 1st-11th lectures.

1. Introduction: Biochemical engineering and characteristics of biological reaction.
2. Enzyme fundamentals: Enzymes, classification and nomenclature, nature of enzymes, and characteristics of enzyme reactions.
3. Enzyme kinetics (1): Equilibrium of bioreaction, M-M type reaction, reaction rate constants, and typical enzyme inhibition types.
4. Enzyme kinetics (2): Multi-substrate reaction, pH dependency, temperature dependency, and deactivation kinetics.
5. Applications of enzyme reactions: Industrial enzyme reactions, analytical and diagnostic techniques, immobilized enzymes, and immobilized biocatalysts.
6. Growth and production kinetics of cells (1): Cells as biocatalysts, and modeling of cell growth.
7. Growth and production kinetics of cells (2): Kinetics of balanced growth, Monod equation, evaluation of kinetic constants, and cell growth in batch cultivation.

8. Growth and production kinetics of cells (3): Structured model, substrate consumption rate, metabolite production rate, yield, and death kinetics.
9. Transport phenomena in bioreaction systems (1): Reaction process and transport process, mass transfer in culture system, oxygen transfer in aerobic culture, oxygen transfer rate, and gas-liquid mass transfer.
10. Transport phenomena in bioreaction systems (2): Agitation culture system, mass transfer coefficient, rheology, and heat transfer.
11. Design and analysis of bioreaction systems (1): Various types of bioreactors, operational methods for biochemical reactions, and mixing processes.
12. Design and analysis of bioreaction systems (2): Analysis of continuous culture, large-scale culture, and animal/plant cell culture.
13. Measurement and control of bioreaction systems: Classification of sensors, measurement items, physicochemical sensors, biosensors, and process control methods.
14. Separation process for bioproducts: Centrifugation, cell disruption, sedimentation, extraction, chromatographic separation, electrophoresis, crystallization, and freeze-drying.
15. Bioprocess economics: Conceptual design, fixed costs, variable costs, and cost evaluation.
16. Final examination.

[Keywords] enzyme, enzyme reaction rate, M-M equation, reaction inhibition, multi-substrate reaction, pH dependency, temperature dependency, deactivation kinetics, industrial enzyme reactions, immobilized enzyme, immobilized biocatalysts/cells, cell growth model, balanced growth, Monod equation, kinetic constants, batch cultivation, structured model, substrate consumption rate, metabolite production rate, yield, death kinetics, reaction process and transport process, mass transfer in culture system, aerobic culture, oxygen transfer rate, gas-liquid mass transfer, agitation culture system, mass transfer coefficient, rheology, heat transfer, bioreactor, operation of bioreactor, mixing process, continuous culture, biosensor, process control methods, byproduct, centrifugation, cell disruption, membrane separation, chromatographic separation, fixed costs, variable costs, and cost evaluation.

[Textbooks and Reference Books] Printed synopses are distributed in each lecture. Reference books:
(1) “Seibutsu Hannou Kogaku (Bioreaction Engineering)” 3rd. ed. (in Japanese) by Tsuneo Yamae, Sangyo Tosyo (2002),
(2) “Kagaku Kogaku (Chemical Engineering)” (in Japanese), by Minoru Seki et al., Igaku Hyoronsya (2012).

[Evaluation] Students will be evaluated by the scores of Exercises & Quizzes (assignments) (10-20%) and Test (80-90%). The Quizzes will be easy challenges for self-assessment on verification of understanding degree during the class. The Exercises learned outside the classroom for target achievement are important because the students themselves solve the processes. Therefore, the evaluation shall be based on whether there are attempts for the challenges to be answered carefully. In case of late submission, penalty shall be according to the degree of the delay. Since the end-of term examination is intended to evaluate the degree of target achievement, the percentage of correct answers shall be evaluated. The combined score of both is not less than 60 points.

[Related courses] Biochemistry I, II, Chemical Reaction Engineering, Chemical Engineering, Physical Chemistry II

[Remarks] Attendance of more than 2/3 is requisite.

無機構造化学　Chemistry of Inorganic Materials
[Instructor] Yasuhiko Iwadate
[Credits] 2
[Semester] 3rd year-Spring-Mon 3
[Course code] T1M139001
[Room] Bldg. ENG-5-204
[Candidate] Specially Registered Non-Degree Student may take this course. This course is mainly for the 3rd year students of Department of Applied Chemistry and Biotechnology; “Elective compulsory” for the students of Applied Chemistry Course).
[Course description] After obtaining the basic knowledge in inorganic chemistry l and ll, the theory of x-ray diffraction that has been established will be described as one of the important methodologies in inorganic chemistry, and the student will understand the basic concepts.　Furthermore, the lecture will be until the introduction of XAFS method that has been widely used in recent years.
[Course objectives] It is not only the elements and their binding mode are contained in the properties of substances and materials, but also the resulting spatial arrangement (structure) and structural units are also highly depended on the state of aggregation.　The student will intensify the understanding of x-ray diffraction and XAFS methods which are essential techniques of structural analysis on the field of study, the student will also study the fundamentals of properties of structure of amorphous material as well as crystals.
[Plans and Contents] Promote a lecture while showing a video using the OA equipment and, if necessary, their own material, while improving the level of understanding to grasp the unit test by imposing reporting and then finally, the learning results shall be evaluated based from the final exams.　As learning outside the class, preparations and review of handouts shall be imposed.
1. General theory on diffraction phenomenon
2. Diffraction grating
3. X-ray diffraction and history
4. Properties of X-rays
5. Interaction between X-rays and substances (transmission, scattering, absorption)
6. X-ray scattering by electrons
7. X-ray scattering by atoms
8. X-ray scattering by microcrystals
9. Types and characteristics of chemical and physical information derived from diffraction
10. Full explanation of experimental procedure in X-ray diffraction
11. Absorption of X-rays (linear absorption coefficient, mass absorption coefficient)
12. Principle of XAFS method
13. Application of XAFS method
14. Structure of amorphous materials
15. Physicochemical characteristics of amorphous materials
16. Summary and end-of-term exam

[Keywords] Diffraction theory and history，property of X-ray，scattering and absorption of X-ray，Experimental manipulation of X-ray diffraction，XAFS technique，structure and property of amorphous materials.
[Textbooks and Reference Books] Textbook: not applicable，Reference books: B. D. Cullity, Shinban-ekkususen-kaisetu-youron, Agune (1980); I. Nitta, Ekkususen-kesshougaku (jou, ge), Maruzen (1959, 1961); Y. Waseda・E. Matsubara, ekkususen-Kouzoukaiseki:gennsi-no-hairetsu-wo-kimeru,Uchida-Roukakuho（1998）;T. Ohta (Ed.),Ekkususen-kyuushuu-bunnkouhou―XAFS to sonoouyou--,IPC（2002）.
[Evaluation] Overall evaluation to be based on teaching unit test (20%), end-of-term test (40%), with another 40% to be added for reports. In the event that cheating or unfair means is detected during examinations, the relevant students cannot take their credits and will be punished in accordance with the school rules.　The deadline of the reports is one week before the end-of-term exam.
[Related courses] Fundamental Chemistry A，Inorganic Chemistry I, II
[Course requirements] Students are recommended to take Inorganic Chemistry II after taking Fundamental Chemistry A (compulsory) and Inorganic Chemistry I (compulsory).
[Remarks] Office hour：First half-term, Monday 17:40- (Student must take an appointment by email), Located: Bldg. ENG-1-217.

セラミックス化学　Ceramics Chemistry
[Instructor] Takashi Kojima
[Credits] 2
[Semester] 3rd year-Spring-Mon 4
[Course code] T1M140001
[Room] Bldg. ENG-5-204
[Candidate] Students of faculty of Engineering,and Other Faculties.
[Course description] Along with the explanation of general ceramics, it shall be considered from the structure, manufacturing, chemical and physical sides etc. Based on above-mentioned characteristics of ceramics, the students shall be instructed to be able to understand ceramic materials.
[Course objectives]
(Objective): Acquire basic knowledge of ceramics chemistry.　(Achievement targets): 1. Understand the microstructural elements of ceramics and be able to understand the evaluation methods and evaluation parameters.　2. Learn the various preparation and manufacturing method of ceramics.　3. Understand how to read a phase diagram.　4. Learn about surface tension and boundary surface tension, and the large impact that they exert on the behavior of ceramics.　5. Learn about the molding methods for ceramics and the elements that determine those characteristics.　6. Understand the diffusion that determines the sintering behavior of ceramics and the defects that have closely related.　7. Understand the sintering mechanism.　8. Understand the functionality expressed by ceramics and the parameters for evaluating this.
[Plans and Contents] The ceramic is one of the most important materials in the inorganic material.　The student will understand the ceramics as the actual industrial material from a scientific standpoint.

1. Lecture outline, ceramics outline: (extracurricular studies) prepare the specified textbook and go through the learning materials.
2. Outline of ceramics: (extracurricular studies) Go through Chapter 1 of the textbook.
3. Structure of ceramics: (extracurricular studies) Go through Chapter 2 of the textbook.
4. Control of crystal phase and phase diagram 1: (extracurricular studies) Go through Section 4.1 of the textbook.
5. Control of crystal phase and phase diagram 2: (extracurricular studies) Go through Section 4.1 of the textbook.
6. Surface and interface: (extracurricular studies) Go through Section 4.2 of the textbook.
7. Defects: (extracurricular studies) Go through Section 4.4 of the textbook.
8. Summary of the first half of the lectures and comprehension test (mid-term test).
9. Diffusion and sintering:　(extracurricular studies) Go through Section 4.5 of the textbook.
10. Synthesis process of ceramics 1: (extracurricular studies) Go through Chapter 3 of the textbook.
11. Synthesis process of ceramics 2: (extracurricular studies) Go through Chapter 3 of the textbook.
12. Inductive materials, conductive materials: (extracurricular studies) Go through Sections 5.1 and 5.2 of the textbook.
13. Magnetic materials, optical materials: (extracurricular studies) Go through Sections 5.3 and 5.4 of the textbook.
14. Structural materials, biomaterials: (extracurricular studies) Go through Sections 5.6 and 5.7 of the textbook.
15. Overall summary and comprehension test (end-of-term test).
16. Recapitulation and explanation of end-of-term exam.

[Keywords] ceramics, processing, sintering, electro-magnetic properties, mechanical properties
[Textbooks and Reference Books] Kakegawa et al.,　Functional Ceramics Chemistry (Kinousei Seramikkusu Kagaku), Asakura Syoten ISBN4-254-25585-3
[Evaluation] Scores of the midterm exam (30%), end-of-term exam (40%), and the attendance short test (30%) will be used for evaluation.　Students should present more than 80% of lectures.
[Related courses] Inorganic Chemistry I, Inorganic Chemistry II, Solid State Chemistry
[Course requirements] Students have preferably taken courses of Solid State Chemistry.
[Remarks] Office hour: Friday

有機工業化学　Industrial Organic Chemistry
[Instructor] (Toshio Sato), (Shinji Abe), (Mariko Kida), (Takeharu Isaki), (Akihiko Yamamoto), (Kazuyoshi Kamata)
[Credits] 2
[Semester] 3rd year-Spring-Fri 5
[Course code] T1M142001
[Room] Bldg. ENG-5-204
[Course description]　Individuals from Mitsui Chemicals, Inc., Japan's leading integrated chemical company, serves as instructors, who introduced multi-faceted production activities, research and development in the field of corporate Japan's petrochemical industry and polymer chemistry and its industry, furthermore the actual safety and environmental measures. This lecture is a rare opportunity wherein we can hear about the actual work from those persons in charge in each production, research and safety management.
[Course objectives] Objective: Complete the required courses and learn a lot in fundamental professions, 5 semesters in the 2nd half of the curriculum can be highly specialized, for the chemical industry of Japan and the future course of many students, instructors to engage in research activities and production activities in the enterprise will explain the fact of chemical industry.　With a general understanding of the chemical industry, focusing on polymer chemistry industry and petrochemical industry, thinking about the road after graduation, it will assist in a comprehensive manner also to future learning plans.
Target Achievements: (1) Provides an overview of the chemical industry that can be centered in the petrochemical industry and polymer petrochemical industry.　(2) The student will understand the concept of corporate R & D and production activities carried out under economic conditions surrounding the chemical industry, and social environment.　(3) The student will learn new materials and its development trend that was noted, and can explain it himself.　(4) Address the real problem of the chemical industry and students can participate in group discussions and debate.
[Plans and Contents]　The following 15 lectures will be conducted. Extracurricular lessons (note that the required preparations were given by the coordinating teacher Akazome for a better understanding of the lectures and they are not instructions from the lectures themselves):
◆Preparation for the 1st–3rd lectures: See the Website of the Japan Petrochemical Industry Association on the petrochemical industry and petrochemical industrial complex in Japan. Find out the relationship of several chemical companies including Mitsui Chemicals with the petrochemical industrial complex from the websites of these member companies.
◆Preparation for the 4th and 8th lectures: Revise the properties and compounds (phthalic acid etc.) obtained from the oxidation of benzene, toluene, xylene etc., that were learnt in the lectures on organic chemistry.
◆Preparation for the 5th–7th　lectures: Find out how polymeric materials are being used in daily life from mainly the business and product guide given on the company's website.
◆Preparation for the 9th–12th lectures: Find out the research that is being conducted, focusing on the R & D policy of Mitsui Chemicals in various research and technology areas from the company's website.
◆Preparation for the 13th–14th lectures: Find out the (environmental and social) initiatives in corporate social responsibility (CSR) that Mitsui Chemicals has embarked on from mainly the company's website.

1. Petrochemical Industry (1): The history of chemical industry and outlook of the petrochemical industry (Person-in-charge: Sato)
2. Petrochemical Industry (2): Petrochemical industrial complex (Person-in-charge: Sato)
3. Petrochemical Industry (3): Oil refining and naphtha decomposition (Person-in-charge: Sato)
4. Aromatic chemical industry: Polyester chain (Person-in-charge: Kida)
5. Polymer chemical industry (1): Overview of synthetic resins (manufacture, molding, uses) (Person-in-charge: Yamamoto)
6. Polymer chemical industry (2): Manufacturing technologies of polyolefins I (Person-in-charge: Yamamoto)
7. Polymer chemical industry (3): Manufacturing technologies of polyolefins II (Person-in-charge: Yamamoto)
8. Aromatic chemical industry: Manufacture of aromatics and phenol chains (Person-in-charge: Abe)
9. Advanced materials (1): Outlook on advanced materials (Person-in-charge: Isaki)
10. Advanced materials (2): Biodegradable plastics (Person-in-charge: Isaki)
11. Advanced materials (3): Developmental situation of advanced materials (Person-in-charge: Isaki)
12. Advanced materials (4): Introduction of cutting-edge technologies (Person-in-charge: Isaki)
13. Safety and environmental issues 1: Laws and regulations in the chemical industry (Person-in-charge: Kamata)
14. Safety and environmental issues 2: Recent environmental problems and initiatives of the chemical industry (Person-in-charge: Kamata)
15. Practices in the chemical industry: Work of a chemical engineer (group discussion) (Person-in-charge: Yamamoto)

[Keywords] Chemical industry, Chemical engineering, Petrochemical complex, Integrated chemical company, Research and development (R & D),Safety and environmental problems
[Textbooks and Reference Books] Handouts provided in class.
[Evaluation] Evaluation to be based on reports (70%) and attendance (including group discussion etc.) (30%). The topics for the reports shall be given by each lecturer at the end of the lecture. The reports are mainly for the purpose of checking the level of understanding of the lecture contents, including an overview of the chemical industry focusing on the petrochemical industry and polymer chemical industry, corporate R&D and production activities, advanced materials under notice and trends in their development, safety and environmental problems and so on. Evaluation will also be based on reports covering the developmental problems posed and views on how to resolve these problems.
[Related courses] Safety Engineering, Fundamentals in Chemical Engineering, Polymer Chemistry, Engineering Ethics

インターンシップ Ⅰ　Internship I
[Instructor] Motohiro Akazome, Takashi Kojima
[Credits] 1
[Semester] 3rd year Spring/Fall Intensive
[Course code] T1M145001
[Room]
[Course enrollment] only a few
[Course objectives] Objectives: The aim is to have the exercises performed in the actual industry, regarding matters learned in lectures, experiments and practical training that are offered in the Department of Applied Chemistry in Biotechnology.
Target Achievements:　The students will have a better understanding on real-life experiences regarding contents and methods of the work, understand the relation of content and academic work, or how the contents learned can be compatible with reality.
[Plans and Contents] Exercises will be conducted in the industry regarding the business contents related to the subject of lectures and experiments of the Department of Applied chemistry and Biotechnology.
[Evaluation] Evaluation will be done taking in account the evaluation of the company that received and submitted the report of that student.
[Remarks] For the destination of the internship, students will find themselves what public company is offering and apply there.

インターンシップ II　　Internship II
[Instructor] Motohiro Akazome, Takashi Kojima
[Credits] 2
[Semester] 3rd year Spring/Fall Intensive
[Course code] T1M146001
[Room]
[Course objectives] Objectives: The aim is to have the exercises performed in the actual industry, regarding matters learned in lectures, experiments and practical training that are offered in the Department of Applied Chemistry in Biotechnology.
Target Achievements:　The students will have a better understanding on real-life experiences regarding contents and methods of the work, understand the relation of content and academic work, or how the contents learned can be compatible with reality.
[Plans and Contents] Exercises will be conducted in the industry regarding the business contents related to the subject of lectures and experiments of the Department of Applied chemistry and Biotechnology.
[Evaluation] Evaluation will be done taking in account the evaluation of the company that received and submitted the report of that student.
[Remarks] For the destination of the internship, students will find themselves what public company is offering and apply there.

分析化学実験　Experiment in Analytical Chemistry　(Part 1)
[Instructor] Masanori Fujinami
[Credits] 1
[Semester] 2nd year-Spring-Mon 3, 4 alternate week 2, 4
[Course code] T1M147001, T1M147002
[Room] Bldg. GEN-E, Chemistry Laboratory
[Course enrollment] 60
[Candidate] Students of Department of Applied Chemistry and Biotechnology must take this course. (For those whose Student ID NO. is ODD number).
[Course description] The titration operation, separation operation, and the precipitation preparation in basis chemistry experiment are learned through analytical chemistry experiment.　The subject of analysis is configured to be understood, depending on the chemical state of the experiment in solutions of each by a wide range of metal ions, anions, and organic matter.
[Course objectives] The student will learn Fundamental Chemical Laboratory operations and safety experimental procedures through basic analytical chemistry experiment.　Furthermore, experience the principle analyzed by experiments, with the aim to learn chemistry.　Then, the students will also learn how to write reports.
[Plans and Contents] At about 30 minutes from the beginning of the experiment, after the experiment Lecture, experiment itself shall be conducted.　Make the sufficient preparation of commentary and experimental procedures of the time in charge of the text of the experiment in advance.　Conduct interview with the teachers after every experiment, and complete each experiment by checking.

1. Experiment outline and usage method of test apparatus: Read thoroughly “5. Overview”, “6. Importance of pH” and “7. Experiment apparatus and basic operations” in the experiment textbook and prepare adequately for the lesson.
2. Thin-layer chromatography (separation of organic compounds): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
3. Extraction and qualitative analysis of organic compounds: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
4. Qualitative analysis of cations: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
5. Precipitation titration (fixed quantification of chloride ions): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
6. Oxidation-reduction titration (measurement of chemical oxygen demand): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
7. Solid-phase extraction and chelatometric titration (separation and fixed quantification of metallic ions: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.

[Keywords] Analytical Chemistry, Solution Chemistry
[Textbooks and Reference Books] (Textbook) “Textbook of Experiment in Analytical Chemistry” will be distributed. Make sure you purchase it before the first day of the experiments to prepare for the lesson.　(Reference book) Kiso kara rikaisuru kagaku series 3 “Analytical Chemistry” by Masanori Fujinami et al., Mimizuku-sha.　This book will be used also in the course “Analytical Chemistry I”.
[Evaluation] An experiment, note-taking and questions will be conducted and posed for each lesson. Submission of reports by the deadline is a pre-requisite for credits to be obtained. Evaluation shall be based on the reports submitted. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Analytical Chemistry I
[Remarks] This course is only for those whose Student ID NO. is ODD number. Students should meet at Chemistry Laboratory (Sougou Kosha E Building) at the beginning of the third period (12:50) on Apri. 21.

分析化学実験　Experiment in Analytical Chemistry　(Part 2)
[Instructor] Masanori Fujinami
[Credits] 1
[Semester] 2nd year-Spring-Mon 3, 4 alternate week1, 3
[Course code] T1M147003, T1M147004
[Room] Bldg. GEN-E, Chemistry Laboratory, Chemistry Laboratory
[Course enrollment] 60
[Candidate] Students of Department of Applied Chemistry and Biotechnology must take this course. (For those whose Student ID NO. is EVEN number).
[Course description] The titration operation, separation operation, and the precipitation preparation in basis chemistry experiment are learned through analytical chemistry experiment.　The subject of analysis is configured to be understood, depending on the chemical state of the experiment in solutions of each by a wide range of metal ions, anions, and organic matter.
[Course objectives] The student will learn Fundamental Chemical Laboratory operations and safety experimental procedures through basic analytical chemistry experiment.　Furthermore, experience the principle analyzed by experiments, with the aim to learn chemistry.　Then, the students will also learn how to write reports.
[Plans and Contents] At about 30 minutes from the beginning of the experiment, after the experiment Lecture, experiment itself shall be conducted.　Make the sufficient preparation of commentary and experimental procedures of the time in charge of the text of the experiment in advance.　Conduct interview with the teachers after every experiment, and complete each experiment by checking.

1. Experiment outline and usage method of test apparatus: Read thoroughly “5. Overview”, “6. Importance of pH” and “7. Experiment apparatus and basic operations” in the experiment textbook and prepare adequately for the lesson.
2. Thin-layer chromatography (separation of organic compounds): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
3. Extraction and qualitative analysis of organic compounds: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
4. Qualitative analysis of cations: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
5. Precipitation titration (fixed quantification of chloride ions): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
6. Oxidation-reduction titration (measurement of chemical oxygen demand): Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.
7. Solid-phase extraction and chelatometric titration (separation and fixed quantification of metallic ions: Read thoroughly the experiment textbook and anticipate the outcome. Read thoroughly and understand the relevant sections in the following reference books.

[Keywords] Analytical Chemistry, Solution Chemistry
[Textbooks and Reference Books] (Textbook) “Textbook of Experiment in Analytical Chemistry” will be distributed. Make sure you purchase it before the first day of the experiments to prepare for the lesson.　(Reference book) Kiso kara rikaisuru kagaku series 3 “Analytical Chemistry” by Masanori Fujinami et al., Mimizuku-sha.　This book will be used also in the course “Analytical Chemistry I”.
[Evaluation] An experiment, note-taking and questions will be conducted and posed for each lesson. Submission of reports by the deadline is a pre-requisite for credits to be obtained. Evaluation shall be based on the reports submitted. In the event that cheating or unfair means is detected, the relevant students will be punished in accordance with the school rules.
[Related courses] Analytical Chemistry I
[Remarks] This course is only for those whose Student ID NO. is EVEN number. Students should meet at Chemistry Laboratory (Sougou Kosha E Building) at the beginning of the third period (12:50) on Apri. 15.

共生応用化学実験　Laboratory Work on Applied Chemistry and Biotechnology　(Part 1)
[Instructor] Faculty members
[Credits] 6
[Semester] 3rd year Spring/Fall-Wed 3, 4, 5 and 3 year spring/Fall -Thurs 3, 4, 5
[Course code] T1M148001, T1M148002, T1M148003, T1M148004, T1M148005, T1M148006
[Room] Bldg. ENG-5-105
[Course enrollment] 120
[Candidate] Students of the 3rd year of Department of Applied Chemistry and Biotechnology
[Course description] Each experiment of inorganic - analytical chemistry, physical chemistry, organic chemistry and polymer chemistry shall be conducted in the groups of students.
[Course objectives] Acquire the basic stance throughout each experiment and develop the right knowledge and insight and careful judgment.　In addition, the student will learn how to summarize the experiment and also how to write the report. Then also acquire practical knowledge regarding disaster prevention and treatment of waste, safety considerations and experiments, in carrying out the experiment.　From the above, the purpose is for the student to learn how to create a report on experimental procedure and the basic knowledge required as a chemist and will be able to use them in practice.　In addition, the student will be able to understand and acquire the ability to consider throughout the experiment about the various events and have the ability to explain them.
[Plans and Contents] Please refer to the textbook “Experimental Guidelines for Applied Chemistry and Biotechnology” for the contents of each experiment.　The student must read carefully the textbook in advance, and find out about the required terms or chemicals.　Create and submit a report after each experiment.
[Textbooks and Reference Books] (Textbook) Experimental Guidelines for Applied Chemistry and Biotechnology
[Evaluation] To evaluate the content of the attendance, test proficiency, and reports.　Emphasis on attendance and report submission.　As a general rule, if all the reports have not been submitted, the student cannot acquire a credit.
[Course requirements] (1) The student has already acquired 76 and more credits required for graduation.　(2) Credits of “Chemistry: Basic Experiment” and “Experiment in Analytical Chemistry” must be obtained.

共生応用化学実験　Laboratory Work on Applied Chemistry and Biotechnology　(Part 2)
[Instructor] Motohiro Akazome, Takashi Kojima
[Credits] 6
[Semester] 3rd year Spring/Fall-Wed 3,4,5 and 3rd year Spring/Fall-Thurs 3,4,5
[Course code] T1M148007
[Room]
[Course enrollment] 120
[Course description] Each experiment of inorganic - analytical chemistry, physical chemistry, organic chemistry and polymer chemistry shall be conducted in the groups of students.
[Course objectives] Acquire the basic stance throughout each experiment and develop the right knowledge and insight and careful judgment.　In addition, the student will learn how to summarize the experiment and also how to write the report. Then also acquire practical knowledge regarding disaster prevention and treatment of waste, safety considerations and experiments, in carrying out the experiment.　From the above, the purpose is for the student to learn how to create a report on experimental procedure and the basic knowledge required as a chemist and will be able to use them in practice.　In addition, the student will be able to understand and acquire the ability to consider throughout the experiment about the various events and have the ability to explain them.
[Plans and Contents] Please refer to the textbook “Experimental Guidelines for Applied Chemistry and Biotechnology” for the contents of each experiment.　The student must read carefully the textbook in advance, and find out about the required terms or chemicals.　Create and submit a report after each experiment.
[Textbooks and Reference Books] (Textbook) Experimental Guidelines for Applied Chemistry and Biotechnology
[Evaluation] To evaluate the content of the attendance, test proficiency, and reports. Emphasis on attendance and report submission.　As a general rule, if all the reports have not been submitted, the student cannot acquire a credit.
[Course requirements] Credits of “Chemistry: Basic Experiment” and “Experiment in Analytical Chemistry” must be obtained.

セミナー I　Seminar I
[Instructor] Motohiro Akazome, Takashi Kojima
[Credits] 1
[Semester] 3rd year-Fall-Tues 4
[Course code] T1M149001
[Room]Bldg. ENG-1-3F audiovisual room, Bldg. ENG-2-101, Bldg. ENG-5-104, Bldg. ENG-5-105, Bldg. ENG-5-204, Bldg. ENG-17-111, each lab office (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Candidate] Students of the 3rd year of Department of Applied Chemistry and Biotechnology
[Course description] Small seminars will be held in units of each research area.
[Course objectives] Acquire the basic and advanced knowledge in the affiliated field of research.
[Plans and Contents] It is up to each field of research.
[Evaluation] The instructor for each field of research shall evaluate.　Evaluation method shall differ depending on the field of research.
[Course requirements] (1) The student has already acquired 76 and more credits required for graduation. (2) Credits of “Chemistry: Basic Experiment” and “Experiment in Analytical Chemistry” must be obtained. (3)The student has already finished the specified e-learning course.

化学英語 I　English Technical Communication I
[Instructor] Kyoichi Saito
[Credits] 2
[Semester] 2nd year-Spring-Fri 2
[Course code] T1M152001
[Room] Bldg. ENG-2-202
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.Students of Department of Applied Chemistry and Biotechnology must take this course.
[Course description] The student's final goal would be able to write "concise, correct and concrete" English of science. Only after the students could write, he/she would be able to read deeply.　In addition, the ability to write in English does not exceed the power of Japanese writing; it would be devised to enhance Japanese science writing ability as well.
[Course objectives] To read and write the English of science, it would be useful to learn the "Four Laws" (word law, sentence law, paragraph law, thesis law).　In this course, the student will deal with the basics of the word law and sentence law.　Learn the three major parts of speech (noun, verb, and preposition) and the 5-Key English grammars, through reading the Nobel-Prize-class papers (3 papers by Dr. Shuji Nakamura, Dr. Koichi Tanaka, and Dr. Hideki Shirakawa).　The student will be able to distinguish between the "Exam English not acceptable to work in science" and "English to work in science", by receiving this lesson.
[Plans and Contents] Short tests will be conducted on science words for vocabulary building, during the first 15 minutes each lecture.　On other matters, reviewing is more important than preparing.

1. Characteristics and necessity of scientific English Part 1: Taking note of the differences in "katakana" English when using scientific English. [Required preparation]: Get ready and learn how to use an English-Japanese dictionary.
2. Characteristics and necessity of scientific English Part 2: Learn the English style that is required in the science, e.g., the 3Cs (Concise, Correct, Concrete). [Required preparation]: Check the meaning of English terms used in the printouts distributed in the previous lesson.
3. Powerful verbs Part 1: Learn 10 of 50 powerful verbs that are useful in scientific English through examples in English and perform an analysis of the English text.　Learn about related terms as well. [Required preparation] Thoroughly revise all previous lesson contents.
4. Powerful verbs Part 2: The same as above. [Required preparation] Thoroughly revise all previous lesson contents.
5. Powerful verbs Part 3: The same as above. [Required preparation] Thoroughly revise all previous lesson contents.
6. Powerful verbs Part 4: The same as above. [Required preparation] Thoroughly revise all previous lesson contents.
7. Powerful verbs Part 5: The same as above. [Required preparation] Thoroughly revise all previous lesson contents.
8. Preposition Part 1: Learn how to use prepositions that appear in the paper by Shuji Nakamura (all 3 pages). [Required preparation] Thoroughly revise all previous lesson contents.
9. Preposition Part 2: Learn how to use prepositions that appear in the paper by Koichi Tanaka (all 3 pages). [Required preparation] Repeatedly revise all previous lesson contents.
10. Preposition Part 3: Learn how to use prepositions that appear in the paper by Hideki Shirakawa (all 3 pages). [Required preparation] Repeatedly revise all previous lesson contents.
11. Key English grammar Part 1: Learn about the infinitive "to" through the English text in the papers. [Required preparation] Repeatedly revise all previous lesson contents.
12. Key English grammar Part 2: Learn about parallel structures through the English text in the papers. [Required preparation] Revise all previous lesson contents to be able to explain to someone.
13. Key English grammar Part 3: Learn about the relatives through the English text in the papers. [Required preparation] Revise all previous lesson contents to be able to explain to someone.
14. Key English grammar Part 4: Learn about comparative expressions through the English text in the papers. [Required preparation] Revise all previous lesson contents to be able to explain to someone.
15. Key English grammar Part 5: Learn about the analysis of sentence pattern through the English text in the papers. [Required preparation] Revise all previous lesson contents to be able to explain to someone.
16. End-of-term exam

[Keywords] Science and technology, Scientific English writing, Three major parts of speech, Five-key English grammar, Nobel-Prize-class papers
[Textbooks and Reference Books] [Textbook] The Ultimate Reading Manual for Scientific English featuring Nobel-Prize-Winning Papers（ALC）, "Kikutan Science - Engineering"（ALC）
[Evaluation] Evaluated by considering every short test (30%), interim exam (30%), and the end-of-term exam (40%) in total.
[Related courses] How to Improve your Scientific Writing and Presentation (General education, 1st year, spring semester, Monday the 3rd period), English Technical Communication II (2nd year, fall semester, Friday the 2nd period)
[Course requirements] Students have to be highly-motivated to study English grammar.

化学英語 II　English Technical Communication II
[Instructor] Kyoichi Saito
[Credits] 2
[Semester] 2nd year-Fall-Fri 2
[Course code] T1M153001
[Room] Bldg. ENG-2-202, Bldg. GEN-D- room 53. (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Candidate]Students of faculty of Engineering,other Faculties, and Specially Registered Non-Degree Student.
[Course description] The student's final goal would be able to write "concise, correct and concrete" English of science. Only after the students could write, he/she would be able to read deeply. In addition, the ability to write in English does not exceed the power of Japanese writing; it would be devised to enhance Japanese science writing ability as well. Students will learn to deepen the contents of "English Technical Communication I".
[Course objectives] To read and write the English of science, it would be useful to learn the "Four Laws" (word law, sentence law, paragraph law, thesis law). In this course, student will deal with the basics of paragraph laws and thesis laws. Subsequently, students will learn through a series of problems for the "Level 3 English Technical Writing Test" (by Japanese Society for English Communication). The course aims to equip all of the students attending this lecture with the skills to pass the "Level 3 English Technical Writing Test", with the country's top student coming from among them. Students who attended this course have proceeded to top of the "Level 3 English Technical Writing Test" (supported by the Ministry of Education, Culture, Sports, Science & Technology: MEXT) and win the "MEXT Minister Award" for 2 consecutive years in 2009 and 2010. By attending this course, students will be ready to take on the task of "writing in scientific English".
[Plans and Contents] A mini-test will be conducted for 15 minutes at the beginning of each lesson to revise the contents of the previous lesson (English composition). On other matters, reviewing is more important than preparing, as well as "English Technical Communication I".

1. Four laws in scientific English: Review of the contents of "English Technical Communication I" and explanation of the contents of "English Technical Communication II". [Required preparation] Revise the contents of "English Technical Communication I".
2. Law of Paragraph Part 1: Learn how to create paragraphs [Required preparation]: Create one paragraph on your own.
3. Law of Paragraph Part2: Explain the "flowing keywords" and "flow of conscious terms" in a paragraph [Required preparation]: Thoroughly revise all previous lesson contents.
4. English Technical Writing Test (Level 3) Part 1: Analyze the English sentences in the English composition problems of the 80th Test. [Required preparation]: Thoroughly revise all previous lesson contents.
5. English Technical Writing Test (Level 3) Part 2: Analyze the English sentences in the English composition problems of the 79th Test. [Required preparation]: Thoroughly revise all previous lesson contents.
6. English Technical Writing Test (Level 3) Part 3: Analyze the English sentences in the English composition problems of the 77th Test. [Required preparation]: Completely revise all previous lesson contents.
7. English Technical Writing Test (Level 3) Part 4: Analyze the English sentences in the English composition problems of the 75th Test. [Required preparation]: Completely revise all previous lesson contents.
8. English Technical Writing Test (Level 3) Part 5: Analyze the English sentences in the English composition problems of the 74th Test. [Required preparation]: Completely revise all previous lesson contents.
9. English Technical Writing Test (Level 3) Part 6: Analyze the English sentences in the English composition problems of the 73th Test. [Required preparation]: Repeatedly revise all previous lesson contents.
10. English Technical Writing Test (Level 3) Part 7: Analyze the English sentences in the English composition problems of the 71th Test. [Required preparation]: Repeatedly revise all previous lesson contents.
11. English Technical Writing Test (Level 3) Part 8: Analyze the English sentences in the English composition problems of the 70th Test. [Required preparation]: Repeatedly revise all previous lesson contents.
12. English Technical Writing Test (Level 3) Part 9: Analyze the English sentences in the English composition problems of the 68th Test. [Required preparation]: Seriously revise all previous lesson contents.
13. English Technical Writing Test (Level 3) Part 10: Analyze the English sentences in the English composition problems of the 67th Test. [Required preparation]: Seriously revise all previous lesson contents.
14. Japanese scientific composition Part 1: Solve tutorial questions on the word law and sentence law in Japanese writing. [Required preparation] Seriously revise all previous contents.
15. Japanese scientific composition Part 2: Solve tutorial questions on the paragraph law and thesis law in Japanese writing. [Required preparation] Revise all previous contents as this will be the last opportunity for students to do so.
16. End-of-term exam.

[Keywords] Science and technology, Scientific English writing, Paragraph writing

[Textbooks and Reference Books]　(Textbook) Level 3 English Technical Writing Test 2014（Japan Society for Technical Communication, [Textbooks] The Ultimate Reading Manual for Scientific English featuring Nobel-Prize-Winning Papers（ALC）, ”Kikutan Science –Earth and Energy”（ALC）
[Evaluation] Evaluated by considering every short test (30%), interim exam (30%), and end-of- term exam (40%) in total.
[Related courses] How to Improve your Scientific Writing and Presentation (General education, 1st year, spring semester, Monday the 3rd period),　English Technical Communication I (2nd year, spring semester, Friday the 2nd period)
[Course requirements] Students have to be highly-motivated to study English grammar.　Students have to be prepared to start learning Japanese composition all over again.

卒業研究　Undergraduate Research
[Instructor] Faculty members
[Credits] 8
[Semester] 4th year Spring/Fall Intensive
[Course code] T1M156001
[Room]
[Course objectives] Objective: The aim is to acquire the basic skills for conducting professional research. Objective: In each field of study, the research shall be conducted in accordance with the research theme given by the supervisors; direct guidance will be given by the supervisors, so that the students will develop the research ability in acquiring the necessary fundamental knowledge and experimental skills for research. In addition, students will acquire the ability to collect information etc. required for carrying out research and be able to analyze adequately the obtained results. By performing the graduate research presentation, student will be able to inform someone accurately of the obtained results and knowledge. Furthermore, student can apply their skills comprehensively.
[Plans and Contents] This course is an overall summary of the curriculum of the Department of Applied Chemistry and Biotechnology, utilizing all of the knowledge acquired so far to perform research.　Direction is given by the instructor. Research contents will be directed by his/her supervisors.　To accomplish research objectives, preparative research survey, carrying out experiments and the result analysis etc. will be needed. It is recommended to read academic papers and books carefully, as necessary.
[Evaluation] Overall evaluation to be based on research attitude, contents, presentation performance and thesis of graduation research, with a pass given for a score of 60 points and above.
[Course requirements] (1) Among the credits of the general education courses, specialized basic subjects and specialized compulsory courses required for graduation, the no. of unacquired credits must not exceed 4 credits. (2) The student is required to acquire credits for “Laboratory Work on Applied Chemistry and Biotechnology “. (3) The student is required to acquire a minimum of 113 credits required for graduation in total.
[Remarks] It is an advantage to take “Seminar II” also.　For the students’ registration, please conduct from the “intensive course” column.

セミナー II　Seminar II
[Instructor] Kyoichi Saito, Shiki Yagai
[Credits] 1
[Semester] 4th year-Fall-Intensive
[Course code] T1M157001
[Room]
[Candidate] 4th year of Department of Applied Chemistry and Biotechnology
[Course description] In the assigned laboratory, the purpose is to acquire the basic knowledge and to cultivate presentation skills necessary to carry out the research with seminars and exercises.
[Course objectives] Objective: The purpose is for the students to develop the ability to resolve problems in the actual field of academic and industrial research activities.　Objectives: Organize the knowledge that has been learned until now through seminars and exercises classes, carry out graduate studies, and develop basic capabilities needed to put together through research presentation to be able to take advantage of that skill.
[Plans and Contents] To understand the knowledge and background needed for graduation research and the organization of the knowledge that has been learned in the curriculum of the Department of Applied Chemistry and Biotechnology, assignments will be set and implemented in each lab. It is recommended to read the related academic papers and books carefully to accomplish the assignment.
[Evaluation] Overall evaluation to be based on the attitude to the assignments set by each lab, reports and presentations, obtaining 60 points or more would be the conditions for acquiring a credit.

国際実習 I　International Research Program I
[Instructor] Masahito Kushida
[Credits] 1
[Semester] 1st-4th year-Spring/Fall-Intensive
[Course code] T1M158001
[Room]
[Candidate] Students of Department of Applied Chemistry and Biotechnology
[Course description]　This is a course to acknowledge international activities such as international conferences related to science that are held overseas, practical training in overseas research institutions such as universities and research centers etc.
[Course objectives] The course aims to cultivate the students' skills in advancing international activities and widen the students' perspective through practical scientific training overseas such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies and so on.
[Plans and Contents] International activities such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies, overseas oral presentations, practical work and report writing upon return and so on will be the subject of evaluation for the certification.
[Evaluation]　Evaluation shall be carried out by the supervising faculty member or program teaching staff and credits shall be awarded based on submitted documents.
[Remarks] Those who wish to register for the International Practical Training I should not register for this course. Those who passed the evaluation criteria after the practical training will be registered for the course subsequently by the faculty member in-charge. International practical training can be taken even if the upper limit of the number of registered credits has been reached. (These credits will not be counted in the registered credit limit)

国際実習 II International Research Program II
[Instructor] Masahito Kushida
[Credits] 2
[Semester] 1st-4th year-Spring/Fall-Intensive
[Course code] T1M159001
[Room]
[Candidate] Students of Department of Applied Chemistry and Biotechnology
[Course description] This is a course to acknowledge international activities such as international conferences related to science that are held overseas, practical training in overseas research institutions such as universities and research centers etc.
[Course objectives] The course aims to cultivate the students' skills in advancing international activities and widen the students' perspective through practical scientific training overseas such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies and so on.
[Plans and Contents] International activities such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies, overseas oral presentations, practical work and report writing upon return and so on will be the subject of evaluation for the certification.
[Evaluation] Evaluation shall be carried out by the supervising faculty member or program teaching staff and credits shall be awarded based on submitted documents.
[Remarks] Those who wish to register for the International Practical Training II should not register for this course. Those who passed the evaluation criteria after the practical training will be registered for the course subsequently by the faculty member in-charge. International practical training can be taken even if the upper limit of the number of registered credits has been reached. (These credits will not be counted in the registered credit limit)

造形演習　Design Aesthetics(Lab.)
[Instructor] Akira Ueda
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016001
[Room] Bldg. ENG-2- 201
[Course description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives]　Specific objectives of this course are as follows: (1) to cultivate the attitude to learn; (2) to develop multilateral observation skills; (3) to recognize the existence of various solutions; (4) to enhance presentation skills. In the Design Aesthetics (Lab.) course, students are required to challenge each of these 4 assignments, and continue until they achieve satisfaction. Students will learn to associate their brain and hands, and "move their hands, work up a sweat, let imagination loose, and create."
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assignment 3: Production of a tabletop lamp shade.
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
12. Assignment 4: Modeling of flying object.
13. Assignment 4: Seminar.
14. Assignment 4: Criticism.
15. Exhibition, summary, and criticism.

[Keywords] Observation, Thinking, Design, Presentation
[Textbooks and Reference Books] Not particularly.
[Evaluation] Evaluation is given by attendance works, and presentation.
[Related courses] Not particularly
[Course requirement]　Not particularly
[Remarks] Not particularly

造形演習　Design Aesthetics(Lab.)
[Instructor] Takatoshi Tauchi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016002
[Room] Innovation Plaza, Faculty of Engineering
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Pencil sketch of a hand.
3. Assignment 1: Seminar.
4. Assignment 1: Seminar・Criticism.
5. Assignment 2：:Sketch of a solid object based on the three orthographic views.
6. Assignment 2: Seminar・Criticism
7. Assignment 3：Production of elastic band driven car.
8. Assignment 3: Seminar: Presentation of work based on the research findings.
9. Assignment 3: Production
10. Assignment 3: Presentation.
11. Assignment4: Production of a paper sandal.
12. Assignment4:：　Presentation of work based on the research findings.
13. Assignment4: Production
14. Assignment 4: Presentation.
15. Exhibition and criticism.

[Evaluation] Evaluation is comprehensively given by attendance, works, and the quality of presentation.
[Remarks] Wearing sandals and high-heeled shoes are strictly prohibited in Innovation Plaza, Faculty of Engineering

造形演習　Design Aesthetics(Lab.)
[Instructor] Yoichi Tamagaki, Yoshihiro Shimomura
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016003
[Room] Bldg. ENG-2–atelier(2–601）
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member. [Plans and Contents]
[Evaluation]

造形演習　Design Aesthetics(Lab.)
[Instructor] YosukeYoshioka
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016004
[Room] Bldg. ENG-1- 110
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents] [Evaluation]

造形演習　Design Aesthetics(Lab.)
[Instructor] Ueda Edilson Shindi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code]: T1Y016005
[Room] Bldg. ENG-2- 102
[Course enrollment] 60
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assessment 3: Select a theme from water, fire, soil, or wind, and freely create a form
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
12. Assignment 4: Seminar.
13. Assignment 4: Criticism.
14. Exhibition

[Keywords] Observation, Thinking, Design, move their hands, work up a sweat, let imagination loose, and create Presentation
[Textbooks and Reference Books] Not particularly
[Evaluation] Evaluation is given by attendance, works and quality of presentation. Attendance 40%, Presentation 60%.
[Related courses] Not particularly
[Course requirements] Not particularly
[Remarks] Not particularly

工学倫理　Engineering Ethics
[Instructor] Kenta Ono
[Credits] 2
[Semester] 3rd year-Fall-Mon 5
[Course code] T1Z051001
[Room] Large Lecture Room
※Large Lecture Room is located in 2nd Building of Faculty of Educations,
[Candidate] 2nd to 4th year of Faculty of Engineering (Direction is given by each Department)
[Course description] Engineering is a practical area of learning that utilizes various scientific and technological achievements to enhance our lives and living environment. However, if used in an inappropriate manner, it will create major social dislocations and loss which may even jeopardize our personal lives. This course discusses the missions, norms, roles, rights and responsibilities of engineers in relation to the society from a broad perspective.
[Course objectives] The objective of this course is to acquire the basic concepts and knowledge for engineers to promote the advancement of technology and contribute to society based on sound ethics.
[Plans and Contents] * The schedule and contents are subject to alteration.
1. Introduction to ethics (Kyuichiro Takahashi, Center of General Education, Chiba University)
2. Characteristics of engineering ethics (Keizo Kutsuna, the Center for General Education, Chiba University)
3. Compliance and general principles of ethics (Moriyoshi Konami, professional engineer)
4. Product liability (Moriyoshi Konami, professional engineer)
5. Whistleblowing (Moriyoshi Konami, professional engineer)
6. Resolving ethical problems (Moriyoshi Konami, professional engineer)
7. Preparedness as an engineer and professional (Moriyoshi Konami, professional engineer)
8. Information technology and copyright: Private sound recording and the Copyright Levy Framework for audiovisual recordings (Heitoh Zen, Institute of Media and Information Technology, Chiba University)
9. Proprietary rights including intellectual property rights (1) (Masayoshi Takahashi, patent attorney)
10. Proprietary rights including intellectual property rights (2) (Masayoshi Takahashi, patent attorney)
11. Proprietary rights including intellectual property rights (3) (Masayoshi Takahashi, patent attorney)
12. Natural resource consumption and environmental ethics (Motoi Machida, Safety and Health Organization, Chiba University)
13. Safety and risks (1) (Yukinobu Shinoda, Industrial Safety Consultant)
14. Safety and risks (2) (Yukinobu Shinoda, Industrial Safety Consultant)
15. Group Discussion (Education committee member of each department)

[Keywords] Mission of engineers, morals, obligations, discipline, and engineering ethics.
[Textbooks and Reference Books] 1) Norifumi Saitoh et al., HAJIMETE NO KOUGAKU RINRI (Introduction of Engineering Ethics) second edition, Showado, (2005), 1400 yen + Tax, 2) Taiji Sugimoto et al, GIJYUTUSHA NO RINRI NYUMON (Introduction of ethics for engineer) fourth edition, Maruzen Publishing Co., Ltd., (2008), 1700 yen + Tax
[Evaluation]
Students will be assessed by results of mini-tests at the end of each lecture. Students must attend a minimum of 12 lectures for accreditation. The yes or no entry to Moodle is treated as attendance. Students need to answer it during every review time.
[Course requirements]
Refer to syllabus available online for subject categories of each faculty. Consult a faculty member of Board of Education when the information is not available.
[Remarks] Lecture schedule and contents are subject to alteration depending on availability of lecturers. Students are required to attend the guidance session to be held on the first class.

工業技術概論 Introduction to Industrial Technologies
[Instructor] Yun Lu
[Credits] 2
[Semester] Spring-Mon 5
[Course code] T1Z05400
[Room] Eng.D-Bld.17-111
[Candidate] Students of Faculty of Engineering, and other Faculties
[Course description] First, the course will discuss the development of global industrial technologies with focus on Japanese technologies, changes of people's lives caused by technologies, environment and energy situations, and the history, current situation and future of industrial technologies. The course will also provide lectures on the necessary mindset as industrial engineers, resource research, how to write technical papers, and how to give research presentation, as well as guidance on studying and report writing techniques for students majoring in science and engineering.
[Course objectives] The objective is to increase the understanding of foreign exchange student majoring in science and engineering towards the development of industrial technologies and changes of people's lives caused by technology development, environment and energy situations, and to teach students the basic abilities that are required as industrial engineers (mindset, resource research, how to write technical papers, and how to give research presentation, etc.) as well as guidance on studying and report writing techniques for students majoring in science and engineering. At the same time, the course is aimed to enable foreign exchange students to gain a better understanding on the industrial technologies of Japan and to acquire the ability to contribute to the development of industries and technologies in their home countries or to work in Japanese companies in the future.
[Plans and Contents] The lectures will be given in 2 parts. Part 1: History, current situation and future of industrial technologies (Classes 1 – 9), and Part 2: Path to becoming a researcher. To ensure a better understanding, lecture resumes will be distributed on the web and lectures will be given using a projector. Achievements will be evaluated by reports and presentation (Classes 10 – 15).

1. Orientation and discussion about course content
2. Advances in industrial technology worldwide
3. Advances in industrial technology in Japan
4. Unique industrial technology
5. Industrial technology and life
6. Industrial technology and energy, the environment
7. 21st century industrial technology
8. How to write a report
9. Assignment presentation 1
10. Basic R&D thinking 1
11. Basic R&D thinking 2
12. Resource research
13. How to write a technical paper
14. Research presentations
15. Research presentations 2
16. Research presentations 3

[Textbooks and Reference Books] Textbook is not specified. Handouts will be provided via http://apei.tu.chiba-u.jp/Luyun-HP.html. Reference books will be introduced in class time.
[Evaluation] Attendance（30%) and exercises, report (30%) and presentation (40%), the total score 60 accredited.
[Course requirements] Not particularly
[Remarks] Foreign students only, the choice subject (F30 or F36) and no credit for Japanese students（Z99）.

居住のデザインと生活技術 Dwelling Design and　Living Technology
[Instructor] Yun Lu
[Credits] 2
[Semester] Fall-Fri 4
[Course code] T1Z055001
[Room] Eng.D-Bld.17-213
[Course enrollment] about40
[Candidate]Students of faculty of Engineering, Other Faculties, and Specially Registered Non-Degree Students.
[Course description] This course will be led by grand fellow Atsushi Maruyama.
[Course objectives] In the life of a person, there are various schemes being repeated in our given environment, the various designs that lead to scales of city or region from around us cannot be done elsewhere.　For foreign students aiming to go to form a professional environment, firstly, they need to focus on design and life skills for such residence, then think of the parallel development, also, in the present, they need to understand what is being deployed.
[Plans and Contents] We would like to discuss, in seminar format, examples of native students not only in the case in Japan, regarding the technology and lifestyle design for residential, and deepen the understanding. There are also plans of visits outside the university during the term.

1. October 3 – Orientation: What does “living” mean? How have people designed living spaces thus far?
2. October 10 – What types of houses can be found now in Japanese urban and rural areas?
3. October 17 – What types of houses can be found in Japanese historical rural and fishing areas?
4. October 19 (Sunday) – On-site observation: Boso Hudokinooka Open air Museum. (Bus tour)
5. October 24 – What types of houses can be found in Japanese historical urban areas?
6. November 7 – What trends have been seen in designing dining spaces kichen and family room?
7. November 14 – What trends have been seen in designing drawing rooms to allow for social relationships?
8. November 21 – What trends have been seen in designing amusement spaces for Noh and Kabuki?
9. November 28 – What trends have been seen in designing amusement spaces in Tokyo Disney land?
10. December 5 – How people have designed tea houses and Sukiya houses facing four seasons and nature?
11. December 12 – How people have designed tea gardens and imperial villa facing four seasons and nature?
12. December 19– How people designed religious spaces in dwelling houses and community during Bon and Shogatsu?
13. January 9 – How people designed religious spaces, Temples and Shrines in community?
14. January 23 – How people designed religious monument such as five storied pagodas ?
15. January 30 – Summary and Overall Discussion

[Keywords] Dwelling house, Design, Living Technology, Mealtime, Relationship, Religious Belief
[Textbooks and Refrence Books] Textbook is not specified. Reference books will be introduced with the process of class on appropriate time.
[Evaluation] Evaluation will be given by small questionnaire with attendance sheet, presentation of the report in seminars at each research room, and the final report.
[Course requirements] Not particularly
[Remarks] Foreign students only, subject of choice（F30 or F36）and no credit for Japanese students（Z99）