

Course	Semester/Credits	Instructor	Affiliation
Introduction to Basic Chemistry (基礎化学序論)	2nd Semester 2 Credits	組頭 広志	AMC course professors
<p>Course code/number : SCH-OCH201E</p> <p>Course Title : Introduction to Basic Chemistry (基礎化学序論)</p> <p>Purpose/Abstract :</p> <p>This class is offered to freshmen enrolled in the AMC course. Fundamental knowledge and cutting-edge research in chemistry and materials science will be presented in the form of seminars in each laboratory. Throughout these seminars, the differences in high school-level and college-level chemistry will be emphasized, and students will be given motivation for their future studies.</p> <p>Goal :</p> <p>Understanding of the basic fields of university-level chemistry spread over a cross-section of each field, such as organic chemistry, inorganic chemistry, analytical chemistry, biochemistry and physical chemistry.</p> <p>Contents :</p> <p>Following the schedule distributed during the initial class, students will attend seminars and learn the importance of basic chemistry as well as cutting-edge research.</p> <p>Books required/referenced :</p> <p>Indicated by each instructor</p> <p>Preparation and review :</p> <p>Indicated by each instructor</p> <p>Grading :</p> <p>Class attendance, attitude and activity</p> <p>Remarks :</p> <p>主として実践的教育から構成される実務・実践的授業 / Practical business</p>			

Course	Semester/Credits	Instructor	Affiliation
Special Class in Basic Chemistry I (専門基礎化学 I)	3rd Semester 2 Credits	南後 恵理子 奥西 みさき	Quantum beam-based structural biology and chemistry
<p>Course code/number : SCH-PCH211E</p> <p>Course Title : Special Class in Basic Chemistry I</p> <p>Purpose/Abstract :</p> <p>In this lecture, we try to understand fundamentals of the quantum mechanics and quantum chemistry that are required for advanced chemistry courses. Starting with a lecture of the early quantum mechanics, we learn how to formulate the Schrödinger equation, which is the basic equation of quantum mechanics. The basic concept of wavefunctions (= solutions of the Schrödinger equations) are presented to understand the wave nature of particles in atomic scale. Then the simple models for vibrational and rotational motions of molecules, and the electronic state of the hydrogen atom are treated quantum mechanically as the prototypes for more complex atoms and molecules.</p> <p>Goal :</p> <p>Gain the skill to solve simple Schrödinger equations using a problem of a particle in a box. Extend it to solve quantum mechanical problems of the harmonic oscillator and the rigid rotator of diatomic molecules, and the electronic motion of the hydrogen atom.</p> <p>Contents :</p> <p>This course will cover the following themes.</p> <ol style="list-style-type: none"> 1. Outline and introduction to elementary physical chemistry 2. Dawn of the quantum theory 3. The classical wave equation 4. The Schrödinger equation 5. A particle in a box 6. General Principles of quantum mechanics 7. The harmonic oscillator and the rigid rotator 8. The hydrogen atom <p>Books required/referenced :</p> <p>Physical Chemistry - a molecular approach by D.A.McQuarrie and J.D.Simon</p> <p>Preparation and review :</p> <p>Read the textbook before and after the lectures and try to solve the examples in the textbook.</p> <p>Grading :</p> <p>Attendance + Mid-term exam. + Final exam. (+Additional exam)</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Special Class in Basic Chemistry II (専門基礎化学Ⅱ)	3rd Semester 2 Credits	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-INO211E Course Title : 専門基礎化学Ⅱ (AMC)</p> <p>Purpose/Abstract : This course builds from the basic electronic structure of atoms and molecules to bonding in compounds to structure and finally to the relationship between the structure and properties of compounds. It is my aim that students will develop tools needed to predict the properties from the electronic and physical structures of relatively simple compounds.</p> <p>Goal : The goal of this course is to learn the basics of electronic structures of atoms and molecules and bonding. In addition, students will be able to understand the relationship among those topics and the properties of compounds.</p> <p>Contents : Below is a tentative schedule and content for the course. The schedule may be changed due to time constraints or at the discretion of the professor.</p> <ol style="list-style-type: none"> 1. Elemental Origin and Atomic Composition 2. Quantum Mechanics. 3. Periodic Table General Properties and Periodicity, Magnetic Properties 4. Covalent Bonding, Lewis Structure, Molecular Orbital Method 5. Atoms, Molecule, polyatomic molecules 6. Valence bonding method, hybrid orbital, π bond 7. Molecular structure and polarity 8. Symmetry and group theory 9. Group theory molecular orbital, application to molecular vibration 10. Crystal structure (1) 11. Crystal structure (2) 12. Ionic solids 13. Metal and metal like 14. Electric conduction, semiconductor, superconductivity <p>Books required/referenced : Primary text : Inorganic Chemistry 6th Ed, General Chemistry 9th Ed. by Ebbing and Gammon and other texts</p> <p>Preparation and review : You should be reading the chapters and trying problems not assigned by the professor.</p> <p>Grading : Class attendance, homework and two exams</p> <p>Remarks : email : breedlove.brian.b1@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
Special Class in Basic Chemistry III (専門基礎化学Ⅲ)	3rd Semester 2 Credits	和田 健彦	Laboratory of Nanobio Functional Materials/Chemical Biology & Supramolecular Photochirogenesis
<p>Course code/number : SCH-ORG211E Course Title : Special Class in Basic Chemistry II I (Basic Organic Chemistry I)</p> <p>Purpose/Abstract : Purpose/Abstract : Objective and Summary of Class : Students will learn how to understand organic chemical reactions. The purpose is to learn the reactions of basic organic compounds, such as alkanes, alkenes, and organic halides, via the flow of electrons shown using arrows.</p> <ol style="list-style-type: none"> (1) Structure and Bonding. (2) Organic Compounds (3) Stereochemistry (4) Alkanes (5) Alkenes (6) Alkynes <p>Intended for those students majoring in organic chemistry, this class will provide the broad fundamentals of organic chemistry needed to become a chemist. It is desirable to continue taking Chemistry C, Special Class in Basic Chemistry III, and General Organic Chemistry A, B and C as well as to take Exercises in Organic Chemistry A and Organic Chemistry I A and II A (class concerning spectroscopy)</p> <p>Goal :</p> <ul style="list-style-type: none"> •To understand chemical bonds and structure of organic compounds. •To understand stereochemistry. •To understand the main reactions of alkanes via electron flow arrows. •To understand the main reactions of alkenes via electron flow arrows. •To understand the main reactions of alkynes via electron flow arrows. <p>Contents : During the class, chapters 1-8 of "Organic Chemistry, 9th ed." by McMurry will be studied. Basically, I will give quizzes for each chapter, so please do your best in preparation and reviewing using the textbook.</p> <p>Books required/referenced : "Organic Chemistry 9th ed." by John McMurry</p> <p>Preparation and review : Preparation / review / tasks are instructed during lecture.</p> <p>Grading : Quiz and reports and a final exam. Quizzes will be given at the beginning of classes.</p> <p>Remarks : The office hours are basically from 10 am to 5 pm, from Monday to Friday</p>			

Course	Semester/Credits	Instructor	Affiliation
Special Class in Basic Chemistry IV (専門基礎化学Ⅳ)	3rd Semester 2 Credits	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-INO211E</p> <p>Course Title : Special Class in Basic Chemistry IV (AMC)</p> <p>Purpose/Abstract : This class will cover general analytical and inorganic chemistry, such as equilibria, acids and bases, acid–base equilibria, oxidation and reduction reactions, electrochemistry, etc.</p> <p>Goal : Students will gain an understanding in basic topics in analytical and inorganic chemistries, which will aid them in their future studies.</p> <p>Contents : Contents and Schedule : 1. Chemical equilibria 2. Acid and bases 3. Acid–base equilibria 4. Oxidation and reduction 5. Introduction to coordination complexes and solubility 6. Electrochemistry 7. Introduction to symmetry</p> <p>Books required/referenced : Inorganic Chemistry 6th ed. Ebbing and Gammon, General Chemistry 9th ed.</p> <p>Preparation and review : read and do problems in the appropriate chapters</p> <p>Grading : Attendance, homework and two exams</p> <p>Remarks : breedlove.brian.bl@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
General Physical Chemistry A (物理化学概論A)	5th Semester 2 Credits	米田 忠弘	Advanced Scanning Probe Microscopy, IMRAM (Tagen)
<p>Course code/number : SCH-PCH221E</p> <p>Course Title : Thermodynamics and statistical physics</p> <p>Purpose/Abstract : In this course, we study thermodynamics, statistical mechanics, and the properties of many–body systems at finite temperature. The course is intended for the understanding both of chemical physical phenomena appeared in material science. We will cover the classical thermodynamics, the relationship between the macroscopic phenomena and the microscopic properties (statistical mechanics), and the application of these ideas to the observed states of actual materials.</p> <p>Goal : Chemical energetics; entropy; work and reversibility; phase equilibria; solution properties; a statistical approach to chemical energetics and equilibria Introduction to quantum chemistry :- applications to the bonding and structure of molecules, materials and nanoparticles. Molecular properties and reactivity</p> <p>Contents : The following topics will be discussed, each of which takes two weeks. Properties of ideal gases Statistical thermodynamics principles Entropy accounting principles Free–energy functions & the chemical potential Application to multi–phase systems Application to solids, surfaces & nanostructures Fuel cell Topics like as chemical reaction of fuel cells and spin ordering of magnetic materials are both included.</p> <p>Books required/referenced : Hand out materials based on Physical Chemistry – molecular approach by D.A. McQuarrie and J.D. Simon</p> <p>Preparation and review : Homeworks at adequate occasions</p> <p>Grading : Midterm and Final Examination, plus reports of several classes, and the attendance</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
General Physical Chemistry B (物理化学概論B)	4th Semester 2 Credits	組頭 広志	Laboratory of Nano Physical Chemistry
<p>Course code/number : SCH-PCH222E</p> <p>Course Title : General Physical Chemistry B</p> <p>Purpose/Abstract :</p> <p>The course deals with the introduction to the principles of quantum mechanics and their application to chemical systems. Topics include the formalism and mathematical tools of quantum mechanics; approximate methods; atomic structure; the chemical bond, valence bond; and molecular orbital theory.</p> <p>Goal :</p> <p>The aim of this course is that students are able to: (1) understand approximation methods, including the variational method and perturbation theory; (2) explain the atomic structures and their spectroscopic properties; (3) understand the quantum mechanical description of the chemical bond and molecular structures; (4) be familiar with the concept of molecular orbital theory.</p> <p>Contents :</p> <p>The contents and schedule are as shown in below:</p> <ol style="list-style-type: none"> (1) Introduction (2) Approximation method in quantum mechanics: Variational method (3) Approximation method in quantum mechanics: Perturbation theory (4) Structure of the helium atom (5) Multiple electron atoms and the Pauli principle (6) Multiple electron atoms: term symbol and atomic spectra (7) Chemical bond: the hydrogen molecular ion (8) Chemical bond: The molecular orbital method (9) Chemical bond: the structure of diatomic molecules (10) Bonding in polyatomic molecules (11) Hybridization and molecular structure (12) Conjugated pi-electron systems: The Hückel molecular orbital method (13) Computational quantum chemistry <p>Books required/referenced :</p> <p>Physical Chemistry - a molecular approach by D.A. McQuarrie and J.D. Simon</p> <p>Preparation and review :</p> <p>The session time is limited and therefore self-directed learning is important. Students are required to prepare and review for each class.</p> <p>Grading :</p> <p>Students are evaluated on their class attendance, the midterm report, and the final examination.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
General Physical Chemistry C (物理化学概論C)	5th Semester 2 Credits	荒木 保幸	Institute of Multidisciplinary Research for Advanced Materials
<p>Course code/number : SCH-PCH223E</p> <p>Course Title : General Physical Chemistry C</p> <p>Purpose/Abstract :</p> <p>Chemical kinetics, also known as reaction kinetics, is the study of the speed of chemical processes.</p> <p>A study of chemical kinetics includes investigations of how experimental conditions can influence on the speed of a chemical reaction. In this class, appropriate construction of mathematical models that can describe the characteristics of a chemical reaction will be discussed. Concept of "order of reaction" and "how to determine order of reaction along with integrated rate laws" are also the most important topics of this class. Moreover, the enzymatic reaction kinetics will be introduced to understand the specific examples of chemical reaction rate determination. Through the trial to solve the problems in the textbook, the establishment of the knowledge will be achieved.</p> <p>Goal :</p> <p>The main goal is to teach principles of reaction kinetics and catalysis. Topics covered include the laws and theories governing reaction rates and mechanisms in gas, condensed phase and at the solid-liquid interface. Modern experimental approaches to study kinetics in complex chemical and biochemical systems and analysis of experimental data will be introduced. Computational approaches to estimate rates of chemical reactions and</p> <p>study the mechanism of catalysis will be discussed.</p> <p>Contents :</p> <p>Contents and Progress Schedule of the Class:</p> <p>In this class, the contents from Chapter 27 to Chapter 31 of the textbook (Physical Chemistry - a molecular approach by D. A. McQuarrie and J.D. Simon) will be discussed.</p> <p>Chapter 27 / The Kinetic Theory of Gases Chapter 28 / Chemical Kinetics : Rate Laws Chapter 29 / Chemical Kinetics : Reaction Mechanisms Chapter 30 / Gas-phase Reaction Dynamics Chapter 31 / Solid and Surface Chemistry</p> <p>Books required/referenced :</p> <p>Physical Chemistry - a molecular approach by D. A. McQuarrie and J.D. Simon</p> <p>Preparation and review :</p> <p>Students who joins in this class is expected to keep prep.</p> <p>Grading :</p> <p>Record and Evaluation Method:</p> <p>Class attendance (perfect attendance assings 60 points), reports (perfect submission assings 20 points) and scores of final examinations (full score assings 20 points) are totally evaluated.</p> <p>Person who gains over 90 points gets AA score.</p> <p>Remarks :</p> <p>This class will be conducted in English.</p>			

Course	Semester/Credits	Instructor	Affiliation
General Physical Chemistry D (物理化学概論D)	5th Semester 2 Credits	高岡 毅	Advanced Scanning Probe Microscopy
<p>Course code/number : SCH-PCH224E</p> <p>Course Title : Principles of spectroscopic methods in physical chemistry</p> <p>Purpose/Abstract :</p> <p>Starting from a lecture of the basic of spectroscopy, we try to survey modern spectroscopic methods used in physical chemistry.</p> <p>Goal :</p> <p>Gain the skill for the analysis of molecules, focusing on the understanding and application to the spectroscopic methods. We cover wide area of the spectroscopic methods, including optical absorption/emission spectroscopy and magnetic resonance spectroscopy.</p> <p>Contents :</p> <ol style="list-style-type: none"> 1) molecular spectroscopy 2) magnetic resonance NMR 3) photochemistry, laser spectroscopy <p>Books required/referenced :</p> <p>Textbook : Physical Chemistry - a molecular approach by D. A. McQuarrie and J. D. Simon</p> <p>Preparation and review :</p> <p>preparation and review</p> <p>Grading :</p> <p>Score : every week's attendance + Final exam</p> <p>Remarks :</p> <p>Katahira Campus - South Multidisciplinary Research Laboratory Building 1 "E02" Room308 Email : tsuyoshi.takaoka.b1@tohoku.ac.jp Office hours : Mon - Fri, 9 : 00 - 17 : 00 Closed : Saturdays and Sundays</p>			

Course	Semester/Credits	Instructor	Affiliation
Exercises in Physical Chemistry A (物理化学演習A)	4th Semester 1 Credits	米田 忠弘 高岡 毅	Advanced Scanning Probe Microscopy & Laboratories at Katahira Campus.
<p>Course code/number : SCH-PCH251E</p> <p>Course Title : Exercises of problems and topics in physical chemistry A</p> <p>Purpose/Abstract :</p> <p>Through lectures of physical chemistry classes, fundamentals of physical and mathematical knowledge will be lectured. However, it is also necessary to solve actual problems in physical chemistry issues. Topics and exercises in special cases will be extended.</p> <p>Goal :</p> <p>In this course, we try to solve problems related to the issues discussed in AMC courses. The goal of this class is to require skills through these process.</p> <p>Contents :</p> <p>Part of this class will go along with 'Problems and solutions to accompany Physical Chemistry - molecular approach by D.A. McQuarrie and J.D. Simon' in which the problems shown in each chapter of the text book are analyzed.</p> <p>Books required/referenced :</p> <p>Indicated by each instructor.</p> <p>Preparation and review :</p> <p>Homework at adequate occasions</p> <p>Grading :</p> <p>class attendance, reports and scores of examinations</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Exercises in Physical Chemistry B (物理化学演習B)	5th Semester 1 Credits	米田 忠弘	Advanced Scanning Probe Microscopy & Laboratories at Katahira Campus.
<p>Course code/number : SCH-PCH252E</p> <p>Course Title : Exercises of problems and topics in physical chemistry B</p> <p>Purpose/Abstract :</p> <p>Through lectures of physical chemistry classes, fundamentals of physical and mathematical knowledge will be lectured. However, it is also necessary to solve actual problems in physical chemistry issues. Topics and exercises in special cases will be extended.</p> <p>Goal :</p> <p>In this course, we try to solve problems related to the issues discussed in AMC courses. The goal of this class is to require skills through these process.</p> <p>Contents :</p> <p>Part of this class will go along with 'Problems and solutions to accompany Physical Chemistry – molecular approach by D.A. McQuarrie and J.D. Simon' in which the problems shown in each chapter of the text book are analyzed.</p> <p>Books required/referenced :</p> <p>indicated by each instructor</p> <p>Preparation and review :</p> <p>Homework at adequation occasions</p> <p>Grading :</p> <p>class attendance, reports and scores of emaminations</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
General Inorganic and Analytical Chemistry A (無機分析化学概論A)	4th Semester 2 Credits	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-INO221E</p> <p>Course Title : General Inorganic and Analytical Chemistry A 無機分析化学概論A (AMC)</p> <p>Purpose/Abstract :</p> <p>Analytical chemistry is an important area of chemistry as it covers not only qualitative analysis of samples using forms of spectroscopy, electrochemistry, etc. and quantification of species in samples but also data analysis. This class is designed for students to gain knowledge in analytical techniques and concepts involved in those techniques.</p> <p>Goal :</p> <p>The goal of this course is for students to learn what is used in chemical analysis and some tools to help them perform chemical analysis.</p> <p>Contents :</p> <p>Below is a tentative schedule :</p> <ol style="list-style-type: none"> 1. Overview 2. Separation techniques 3. Activity and equilibrium 4. Spectroscopy 5. Mass Spectrometry and nuclear magnetic resonance 6. Electrochemistry <p>Books required/referenced :</p> <p>Fundamentals of Analytical Chemistry 9ed; Skoog, West., Holler and Crouch</p> <p>Preparation and review :</p> <p>read the book</p> <p>Grading :</p> <p>Attendance and two exams</p> <p>Remarks :</p> <p>breedlove.brian.bl@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
General Inorganic and Analytical Chemistry B (無機分析化学概論B)	4th Semester 2 Credits	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-INO222E</p> <p>Course Title : General Inorganic and Analytical Chemistry B (AMC)</p> <p>Purpose/Abstract :</p> <p>This class is a survey of the general properties and reactivity of main group elements and transition metals. During the course, we cover chapters 9–22 in Inorganic Chemistry, 6th ed.</p> <p>Goal :</p> <p>The goal of this class is to learn the general trends in reactivity of the chemical elements.</p> <p>Contents :</p> <p>Contents and Schedule :</p> <ol style="list-style-type: none"> 1. Chemistry of main group elements 2. d-Block metals 3. Structure of d-block metal complexes 4. Basics of coordination chemistry <p>Books required/referenced :</p> <p>Inorganic Chemistry 6th Ed. (formerly Shriver and Atkins)</p> <p>Preparation and review :</p> <p>Read the chapters and do the problems at the end of the chapter</p> <p>Grading :</p> <p>Attendance and two exams</p> <p>Remarks :</p> <p>breedlove.brian.bl@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
General Inorganic and Analytical Chemistry C (無機分析化学概論C)	5th Semester 2 Credits	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-INO223E</p> <p>Course Title : General Inorganic and Analytical Chemistry C (AMC)</p> <p>Purpose/Abstract :</p> <p>The objective of this class is to introduce frontiers of inorganic chemistry. The aim of the class is to show how developments in inorganic chemistry impinges on the other disciplines, such as life science, condensed matter physics, and materials chemistry. We will discuss materials chemistry focusing on solid-state compounds, their structures, and electronic, magnetic, and optical properties. In addition, we will discuss nanomaterials and biosensors and introduce the area of catalysis.</p> <p>Goal :</p> <p>Students will gain an understanding of the properties of solid-state materials and nanomaterials and learn about f-block elements. In addition, you will learn basic concepts of catalysis and biosensors.</p> <p>Contents :</p> <p>Basic Contents and Schedule :</p> <ol style="list-style-type: none"> 1. f-block elements 2. Introduction to catalysis 3. Homogeneous catalysis 4. Heterogeneous catalysis 5. Other catalytic systems (e.g., photocatalysis and electrocatalysis) 6. Biological inorganic chemistry 7. Biological inorganic processes 8. Band structures of solids and semiconductors 9. Magnetic properties of solids 10. Electronic properties of solids 11. Optical properties of solids 12. Solid-state and materials chemistry 13. Nanoscience 14. Biosensors <p>Books required/referenced :</p> <p>Inorganic Chemistry 6th Ed.</p> <p>Preparation and review :</p> <p>reading</p> <p>Grading :</p> <p>Class attendance and two exams</p> <p>Remarks :</p> <p>breedlove.brian.bl@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
General Inorganic and Analytical Chemistry D (無機分析化学概論D)	6th Semester 2 Credits	火原 彰秀	Laboratory of Nano-Micro Chemical Analysis
<p>Course code/number : SCH-INO224E</p> <p>Course Title : General Analytical Chemistry: two-phase equilibrium, electroanalytical chemistry, and instrumental analysis</p> <p>Purpose/Abstract : In this course, students will understand various analytical methods based on the fundamental knowledge on analytical chemistry learnt in Special Class in Basic Chemistry IV.</p> <p>Goal : The purpose of this course is to help students explain principles, apparatuses, and applications of the analytical methods from the viewpoint of selectivity and sensitivity.</p> <p>Contents : This is a lecture-centered course with short quiz and homework report. The contents and schedule are as shown below: 1) Introduction 2) Electrochemistry 3) Potentiometry and coulometry 4) Ion selective electrode and other sensors 5) Two-phase equilibrium and extraction 6) Principle of chromatography 7) Partition chromatography 8) Ion chromatography and size exclusion chromatography 9) Review of electroanalytical chemistry, extraction, and chromatography 10) States of atoms 11) Atomic absorption spectroscopy 12) Inductively-coupled plasma optical emission and mass spectroscopies 13) X-ray generation and detection 14) X-ray fluorescence 15) Review of atomic and x-ray spectroscopies</p> <p>Books required/referenced : References are handed out at every class.</p> <p>Preparation and review : Students are expected to do homework (review).</p> <p>Grading : Quizzes in class, homework reports, and examination(s)</p> <p>Remarks : Bring your scientific calculator. E-mail : hibara@tohoku.ac.jp Lab homepage : http://www2.tagen.tohoku.ac.jp/lab/hibara/ Office hour : weekday 13:00-18:00, IMRAM West Building 1 RoomS211</p>			

Course	Semester/Credits	Instructor	Affiliation
Exercises in Inorganic and Analytical Chemistry B (無機分析化学演習B)	5th Semester 1 Credits	高坂 亘 福山 真央	Laboratory of Solid-State Metal-Complex Chemistry Laboratory of Nano/Micro Chemical Measurements
<p>Course code/number : SCH-INO252E</p> <p>Course Title : Exercises in Inorganic and Analytical Chemistry: From Basic Inorganic Chemistry to Coordination Chemistry and Ligand-Field Theory</p> <p>Purpose/Abstract : Conduct exercises in inorganic and analytical chemistry, in particular an area from basic inorganic chemistry to coordination chemistry related to the solid-state molecular chemistry, by explaining their fields.</p> <p>Goal : To gain a deeper understanding of the course. And we hope that you may be interested in the field of the solid-state molecular chemistry.</p> <p>Contents : Conduct exercises and explanation for the fields. * Basic of quantum chemistry * Molecular orbital and Molecular electronic state * Periodic table and crystal structure * Acid-base and Oxidation-reduction * Thermodynamics and crystal structure * Molecular symmetry * Ligand-field theory * Crystal-field theory * Coordination chemistry 1 * Coordination chemistry 2 * Analytical chemistry 1 * Analytical chemistry 2 * Analytical chemistry 3</p> <p>Books required/referenced : The problem set will be given at each class hour, but the following texts may be useful for your study : Shriver & Atkins' Inorganic Chemistry, by P. Atkins et al., Oxford University Press. D- and F-Block Chemistry, by C. Jones, RSC publisher.</p> <p>Preparation and review : The problems given at each class hour should be solved.</p> <p>Grading : Evaluation will be performed by your attendance records and results of the exercises.</p> <p>Remarks : w-kosaka@imr.tohoku.ac.jp 022-215-2033 maofukuyama@tohoku.ac.jp 022-217-5640</p>			

Course	Semester/Credits	Instructor	Affiliation
General Organic Chemistry A (有機化学概論 A)	4th Semester 2 Credits	水上 進	Laboratory of Cell Functional Molecular Chemistry
<p>Course code/number : SCH-ORG221E</p> <p>Course Title : General Organic Chemistry A</p> <p>Purpose/Abstract : Objective and Summary of Class: This class is part of organic chemistry classes, including Special Class in Basic Chemistry III , and General Organic Chemistry A, C, and D. The lecture covers the following topics :</p> <ol style="list-style-type: none"> (1) Basic chemistry of organic halides. (2) Nucleophilic substitution reactions and reaction theory (3) Diene and allylic systems (4) Conjugated and aromatic compounds (5) Aromatic substitution reactions (6) Properties of alcohols, phenols, ethers, and thiols. <p>This class will provide the broad fundamentals of organic chemistry that are essential for students to be a chemist.</p> <p>Goal : Goal of Study : To understand</p> <ol style="list-style-type: none"> (1) Properties of alkyl halides and related compounds, synthetic methods, radical reactions, principles of the stability of allyl radicals, the characteristics of Grignard reactions (2) Reactions of organic compounds, especially the characteristics and reaction mechanisms of nucleophilic substitutions and aliphatic reactions (3) Stability of conjugated chains, electrophilic reactions, kinetic and thermodynamic control of reactions, and the characteristics of Diels-Alder reactions <p>(4) Structure of benzene and its derivatives, the principles of aromatic stability, heterocyclic aromatic compounds, the Huckel rule, and electrophilic substitution reactions</p> <p>(5) Chemical properties and reactivity of alcohols, phenols, epoxides, and thiols</p> <p>Contents : Contents : The class will involve chapters 10, 11, and 14?18 of Organic Chemistry 9th Ed. by John McMurry. However, the parts in chapter 14 covering spectroscopy will be omitted.</p> <ol style="list-style-type: none"> 1. Introduction 2. Organohalides (Chapter 10) 3. Nucleophilic substitutions and eliminations (Chapter 11) 4. Conjugated compounds (Chapter 14) 5. Benzene and aromaticity (Chapters 15) 6. Electrophilic aromatic substitution (Chapter 16) 7. Alcohols and phenols (Chapter 17) 8. Ethers and epoxides; Thiols and Sulfides (Chapter 18) <p>Books required/referenced : McMurry Organic Chemistry 9th Ed.</p> <p>Preparation and review : Problem-solving exercise</p> <p>Grading : Grading : Evaluation will be performed on the basis of exams, class participation, and homework results.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
General Organic Chemistry C (有機化学概論 C)	5th Semester 2 Credits	鬼塚 和光	Synthetic Chemistry for Biofunctional Molecules
<p>Course code/number : SCH-ORG223E</p> <p>Course Title : General Organic Chemistry C (AMC, Chemistry of Carbonyl Compounds)</p> <p>Purpose/Abstract : Learning the chemistry of carbonyl compounds – main reactions, methods of synthesis, reaction mechanisms and synthetic applications.</p> <p>Goal : Understanding the chemistry of carbonyl compounds.</p> <p>Contents : Lectures based on the textbook, discussions in the class, tests.</p> <p>Chapter 19 Aldehydes and Ketones : Nucleophilic Addition Reactions</p> <p>Chapter 20 Carboxylic Acids and Nitriles</p> <p>Chapter 21 Carboxylic Acid Derivatives</p> <p>Chapter 22 Carbonyl Alpha-Substitution Reactions</p> <p>Chapter 23 Carbonyl Condensation Reactions</p> <p>Books required/referenced : McMurry-Organic Chemistry : chapters 19-23</p> <p>Preparation and review : Reading the textbook, self-training to understand reaction mechanisms.</p> <p>Grading : Attendance of the class, activity in the discussions, test results.</p> <p>Remarks : It is desirable for students to take General Organic Chemistry D as well. General Organic Chemistry C (April-June) General Organic Chemistry D (June-July)</p>			

Course	Semester/Credits	Instructor	Affiliation
General Organic Chemistry D (有機化学概論D)	5th Semester 2 Credits	永次 史	Synthesis of Organic Functional Molecules
<p>Course code/number : SCH-ORG224E Course Title : General Organic Chemistry D Purpose/Abstract : Objective and Summary of Class : This class is part of series of organic chemistry classes, including General Organic Chemistry A, C, and D. This lecture will concern the following topics : (1) Basic chemistry of amines and heterocycles (2) Chemistry of biomolecules 2-1 Carbohydrates 2-2 Aminoacids, Peptides and Proteins 2-3 Lipids 2-4 Nucleic acids (3) The organic chemistry of metabolic pathway (4) Pericyclic reactions : electrocyclic reactions, cyclo additions and sigmatropic rearrangements</p> <p>Goal : Goal of Study (1) To understand the synthetic method of amines and reactions of amines (2) To understand the chemical properties and reactivity of heterocyclic amines (3) To understand the structures and biological functions of biomolecules (carbohydrates, amino acids, peptides, proteins, lipids and nucleic acids) (4) To understand the organic chemistry of metabolic pathway in the cells of living organisms (5) To understand the pericyclic reactions by molecular orbital theory</p> <p>Contents : The class will involve chapters 24-30 of Organic Chemistry by John McMurry.</p> <p>Books required/referenced : Textbook and References : "Organic Chemistry 8th ed." by John McMurry</p> <p>Preparation and review : They should do the homework, which is assigned in the class. In addition, they should do the exercise in the text book.</p> <p>Grading : Record and Evaluation Method : Evaluation will be performed on the basis of exam and the homework results.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Exercises in Organic Chemistry A (有機化学演習A)	4th Semester 1 Credit	永次 史 水上 進 和田 健彦	Institute of Multidisciplinary Research for Advanced Materials
<p>Course code/number : SCH-ORG251E Course Title : Exercises in Organic Chemistry A Purpose/Abstract : Objective and Summary of Class : Understanding of organic chemistry will be deepened by performing exercises based on the lecture contents of "Chemistry C" and "Special Class in Basic Chemistry III" and in parallel "General Organic Chemistry A" and "Laboratory Experiments in Chemistry A" (up to chapter 18 in McMurry, "Organic Chemistry", 8th ed.)</p> <p>Goal : It will be possible to explain basic organic chemistry in real terms. In particular, organic reaction mechanisms can be described with arrows showing the movement of electrons.</p> <p>Contents : The problems at the end of each chapter of McMurry's "Organic Chemistry", 8th ed. up to chapter 18 will be performed. Details will be explained during the 1st lecture.</p> <p>Books required/referenced : McMurry "Organic Chemistry", 8th ed. and 9th ed. References will be introduced accordingly.</p> <p>Preparation and review : You should study the exercise in the McMurry's "Organic Chemistry", 8th ed. (chapters 1-18)</p> <p>Grading : Evaluation will be based on attendance and the number of exercise answers given. Additional points will be given for answers written on the blackboard.</p> <p>Remarks : 主として実践的教育から構成される実務・実践的授業 / Practical business</p>			

Course	Semester/Credits	Instructor	Affiliation
Exercises in Organic Chemistry B (有機化学演習B)	5th Semester 1 Credit	永次 史 和田 健彦	Institute of Multidisciplinary Research for Advanced Materials
<p>Course code/number : SCH-ORG252E</p> <p>Course Title : Exercises in Organic Chemistry B</p> <p>Purpose/Abstract :</p> <p>Understanding of organic chemistry will be deepened by performing exercises based on the lecture contents of "General Organic Chemistry C" and "General Organic Chemistry D" (from chapter 19 up to chapter 29 in McMurry, "Organic Chemistry", 8th ed.)</p> <p>Goal :</p> <p>It will be possible to explain basic organic chemistry in real terms. In particular, organic reaction mechanisms can be described with arrows showing the movement of electrons.</p> <p>Contents :</p> <p>The problems at the end of each chapter of McMurry's "Organic Chemistry", 8th ed. (chapters 19-29) will be performed. Details will be explained during the 1st lecture.</p> <p>Books required/referenced :</p> <p>McMurry "Organic Chemistry", 8th ed. References will be introduced accordingly.</p> <p>Preparation and review :</p> <p>You should study the exercise in the McMurry's "Organic Chemistry", 8th ed. (chapters 19-29) .</p> <p>Grading :</p> <p>Evaluation will be based on attendance and the number of exercise answers given. Additional points will be given for answers written on the blackboard.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
General Biochemistry (生物化学概論)	3rd Semester 2 Credits	稲葉 謙次	Laboratory of Biomolecular Structure
<p>Course code/number : SCH-BIC211E</p> <p>Course Title : General Biochemistry (生物化学概論)</p> <p>Purpose/Abstract :</p> <p>To study the basic knowledge of molecular biology, biochemistry and structural biology and to understand biological phenomena at the molecular level, students will learn the following contents.</p> <ol style="list-style-type: none"> 1) Structures and chemical properties of nucleic acids 2) Structures and chemical properties of amino acids and proteins 3) Biochemical methods for analyzing DNA sequence, amino acid sequence, protein structures and functions 4) Mechanisms of enzyme catalysis <p>Goal :</p> <p>Students will gain deep insights into structures and physiological functions of nucleic acids, proteins and other important biomolecules. Also, students will understand molecular mechanisms of several important enzymes.</p> <p>Contents :</p> <p>Lectures will follow a textbook indicated below. Especially, we will learn Chapters 1-9 of the textbook.</p> <p>Books required/referenced :</p> <p>Berg, Tymoczko and Stryer, Biochemistry, 7th international edition.</p> <p>Preparation and review :</p> <p>A short test will be given as a homework in the end of every class.</p> <p>Grading :</p> <p>Attendance, attitude in class and results of examinations will be taken into consideration for grading.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Biochemistry I A (生物化学 I A)	4th Semester 2 Credits	高橋 聡	Laboratory of Biological and Molecular Dynamics
<p>Course code/number : SCH-BIC221E Course Title : The Molecular Design of Life and Biological Energy Transduction</p> <p>Purpose/Abstract : To learn the biological phenomena at the molecular level and to gain a deeper understanding of biochemistry, molecular biology and biophysics. Students will learn:</p> <ol style="list-style-type: none"> 1. Structures and properties of sugars and lipids, 2. Structures and properties of biological membranes, 3. Biological energy transduction. <p>It is desirable to consistently attend the discussions in Biochemistry IIA concerning the DNA and RNA synthesis and metabolism of biomolecules.</p> <p>Goal : Students will gain an understanding of the functions of sugars, polysaccharides, lipids and membranes on the basis of their structures and thermodynamics. In addition, students will understand the process in which glucose is converted into ATP as energy currency.</p> <p>Contents :</p> <p>1st lecture Carbohydrates I 2nd lecture Carbohydrates II 3rd lecture Lipids and cell membranes I 4th lecture Lipids and cell membranes II 5th lecture Membrane Channels and Pumps I 6th lecture Membrane Channels and Pumps II 7th lecture Signal Transduction Pathways Mid term test</p> <p>8th lecture Metabolism: Basic concepts and Design 9th lecture Glycolysis and Glugoneogenesis I 10th lecture Glycolysis and Glugoneogenesis II 11th lecture The Citric Acid Cycle 12th lecture Oxidative Phospholylation I 13th lecture Oxidative Phospholylation II FInal test 14th lecture Epilogue : Lives of Warburg, Mayerhoff and Krebs</p> <p>Books required/referenced : Berg, Tymoczko, Gatto and Stryer, Biochemistry, 9th edition (WH Freeman). The lectures will cover chapters 10 to 18 of the textbook.</p> <p>Preparation and review : Students will be asked to submit homework every week.</p> <p>Grading : The results of examinations and attendance will be taken into consideration for evaluation.</p> <p>Remarks : The contact address of Satoshi Takahashi is as follows: IMRAM, east building 1 in Katahira campus, room 208. Email : satoshi.takahashi.a6@tohoku.ac.jp Students are welcomed to visit my office. Please make an appointment by email.</p>			

Course	Semester/Credits	Instructor	Affiliation
Basic Experiments in Chemistry (基礎化学実験)	6th Semester 1 Credit	豊田 耕三	Laboratory of Fundamental Chemistry
<p>Course code/number : SCH-OCH251E Course Title : Laboratory Experiments in Basic Chemistry</p> <p>Purpose/Abstract : You learn experimental operations of basic inorganic chemistry, basic analytical chemistry, basic physical chemistry, and basic organic chemistry.</p> <p>Goal : You can make fundamental experiments of basic inorganic chemistry, basic analytical chemistry, basic physical chemistry, and basic organic chemistry.</p> <p>Contents :</p> <ol style="list-style-type: none"> (1) Basic operations Calibration of volumetric measuring instruments (2) Titrations Neutralization titration Precipitation titration Oxidation-reduction titration Complexometric titration Neutralization titration curves and acid dissociation constants of weak acids (3) Analyses of absorption spectra using UV-vis spectrophotometer (4) Measurement of enthalpy changes in neutralization and dissolving salts (5) Syntheses of organic compounds Synthesis of 6,6-nylon from cyclohexene Synthesis of Aspirin <p>Books required/referenced : Textbooks (directions for the experiments) will be given in the class; other references are shown in the directions.</p> <p>Preparation and review : Read the textbook and draw a flow chart of the experiment, in advance.</p> <p>Grading : Evaluation will be performed by your attendance records and laboratory reports.</p> <p>Remarks : Telephone : 022-795-6606 (staff room) : E-mail : kozo.toyota.d3@tohoku.ac.jp 主として実践的教育から構成される実務・実践の授業 / Practical business</p>			

Course	Semester/Credits	Instructor	Affiliation
Laboratory Experiments in Chemistry A (化学一般実験A)	6th Semester 5 Credit	豊田 耕三	Laboratory of Fundamental Chemistry
<p>Course code/number : SCH-OCH252E</p> <p>Course Title : Laboratory Experiments in Chemistry</p> <p>Purpose/Abstract : You learn fundamental experimental operations of inorganic chemistry, analytical chemistry, and the related fields.</p> <p>Goal : You can make fundamental experiments of inorganic chemistry, analytical chemistry, and the related fields.</p> <p>Contents :</p> <ul style="list-style-type: none"> (1) Inorganic experiments <ul style="list-style-type: none"> Synthesis of chemicals used for measurements Complex synthesis X-ray crystal structure analysis UV-visible absorption spectra of metal complexes Complex formation reaction rates Cyclic voltammetry of metal complexes (2) Analytical experiments <ul style="list-style-type: none"> Determination of the composition of an iron phenanthroline complex by using spectrophotometry Determination of fluoride ion contents by using an iron-selective electrode (3) Optional experiments and exercises <p>Books required/referenced : Textbooks (directions for the experiments) will be given in the class; other references are shown in the directions.</p> <p>Preparation and review : Read the textbook and draw a flow chart of the experiment, in advance.</p> <p>Grading : Evaluation will be performed by your attendance records and laboratory reports.</p> <p>Remarks : Telephone : 022-795-6606 (staff room) ; E-mail : kozo.toyota.d3@tohoku.ac.jp 主として実践的教育から構成される実務・実践的授業 / Practical business</p>			

Course	Semester/Credits	Instructor	Affiliation
Laboratory Experiments in Chemistry B (化学一般実験B)	7th Semester 6 Credit	豊田 耕三	Laboratory of Fundamental Chemistry
<p>Course code/number : SCH-OCH253E</p> <p>Course Title : Laboratory Experiments in Chemistry</p> <p>Purpose/Abstract : You learn fundamental experimental operations of physical chemistry, organic chemistry, and biochemistry.</p> <p>Goal : You can make fundamental experiments of physical chemistry, organic chemistry, and biochemistry.</p> <p>Contents :</p> <ul style="list-style-type: none"> (1) Physical chemistry experiments <ul style="list-style-type: none"> Optics and molecular spectroscopy Molecular spectroscopy in solutions Electronics Computer calculation experiments (2) Organic experiments <ul style="list-style-type: none"> Basic procedures for the organic chemistry experiments Grignard synthesis of triphenylmethanol Benzoin condensation and synthesis of hexaphenylbenzene Molecular modeling and various spectroscopic measurements (3) Biochemical experiments <ul style="list-style-type: none"> Enzyme Reaction kinetics Basic gene cloning <p>Books required/referenced : Textbooks (directions for the experiments) will be given in the class; other references are shown in the directions.</p> <p>Preparation and review : Read the textbook and draw a flow chart of the experiment, in advance.</p> <p>Grading : Evaluation will be performed by your attendance records and laboratory reports.</p> <p>Remarks : Telephone : 022-795-6606 (staff room) ; E-mail : kozo.toyota.d3@tohoku.ac.jp 主として実践的教育から構成される実務・実践的授業 / Practical business</p>			

Course	Semester/Credits	Instructor	Affiliation
Analytical Chemistry A (分析化学 A)	5th Semester 1 Credit	福山 真央	Laboratory of Nano-Micro Chemical Measurements
<p>Course code/number : SCH-INO301E</p> <p>Course Title : 化学分析のための統計学とプログラミング</p> <p>Purpose/Abstract : Students will learn statistics and coding to obtain the conclusion from chemical experimental data correctly.</p> <p>Goal : Student will understand the basics for quantitative analysis, multivariate analysis and machine learning which can be applied to chemical researches.</p> <p>Contents : Contents and Schedule : <ol style="list-style-type: none"> 1. Guidance (Instruction of python coding) 2. Experimental error & Gaussian distribution 3. Hypothesis testings (t test and Grubbs test) 4. Quantification using calibration curves 5. Multivariate analysis (lecture) 6. Multivariate analysis (coding) 7. Introduction to machine learning </p> <p>Books required/referenced : "Quantitative Chemical Analysis" by Daniel C. Harris, W. H. Freeman and Company.</p> <p>Preparation and review : The problems given at each class hour should be solved.</p> <p>Grading : Class attendance & quiz in class (40%) , Homework (30%) and Final report (30%)</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Inorganic Chemistry I A (無機化学 I A)	6th Semester 1 Credits	谷口 耕治	Solid-State Metal-Complex Chemistry
<p>Course code/number : SCH-INO303E</p> <p>Course Title : Electronic Properties of Inorganic Materials</p> <p>Purpose/Abstract : Properties of solid are mainly dominated by an electronic structure of material. In this class, we will learn how to understand the atomic bonds, which form a crystal structure, and electric properties such as electrical conductivity of materials based on the electronic structure.</p> <p>Goal : The goal of this class is to understand the relationship between electronic structure and atomic bond/electrical conductivity of solid. One will understand the classification of atomic bonds and the definition of metal and insulator that based on an electronic structure.</p> <p>Contents : <ol style="list-style-type: none"> 1. Introduction (crystal structure, X-ray diffraction) 2. Bonding character in crystal (Relationship between atomic bonding character and crystal structure) 3. Quantum-mechanical treatment of atomic bond (Molecular orbital, LCAO-approximation, Hückel method) 4. Band Theory (Expansion of molecular orbital to crystal) </p> <p>Books required/referenced : The Electronic Structure and Chemistry of Solids (P.A. Cox, OXFORD), Transition Metal Oxides (P. A. Cox, OXFORD), Electronic Structure and The Properties of Solids (W. A. Harrison, Dover), etc.</p> <p>Preparation and review : The session time is limited and therefore self-directed learning is important. Students are required to review for each class.</p> <p>Grading : Class attendance and examination</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Inorganic Chemistry II A (無機化学 II A)	6th Semester 1 Credit	宮坂 等	Division of Solid-State Metal-Complex Chemistry
<p>Course code/number : SCH-INO305E</p> <p>Course Title : Inorganic Chemistry II A</p> <p>Purpose/Abstract : Topics will include the structure and mechanical and physical properties of supramolecular complexes and multi-dimensional framework systems. Each topic assigned to you should be pre-investigated before your presentation. We will get various knowledes on the basic science in the field of supramolecular complexes and multi-dimensional framework systems through our presentation and discussion.</p> <p>Goal : The goal of this course is to gain an understanding of supramolecular chemistry and multi-dimensional framework systems and related chemistry.</p> <p>Contents : After discussion about the basics of supramolecular chemistry and its related chemistry, students will present a topic involving supramolecular chemistry or other related chemistry for discussion by the class.</p> <p>Books required/referenced : Steed and Atwood, Supramolecular Chemistry, 2nd Ed. Wiley, and others</p> <p>Preparation and review : Prepare a lecture and discussion on a topic supramolecular chemistry and related chemistry such as multi-dimensional networks and their physical properties (we mainly use ppt for the presentation)</p> <p>Grading : Attendance and in-class discussions will be used to evaluate the students' progress.</p> <p>Remarks : miyasaka@imr.tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
Physical Chemistry II A (物理化学 II A)	6th Semester 1 Credit	鎌形 清人	Biological and Molecular Dynamics Laboratory
<p>Course code/number : SCH-PCH303E</p> <p>Course Title : Physical chemistry II A</p> <p>Purpose/Abstract : This course focuses on physical chemistry hidden in life sciences. Biomolecules function obeying some rules based on physical chemistry. These physical chemistry bases are deeply discussed while introducing Nobel Prize stories and hot research topics.</p> <p>Goal : This course is designed to help students understand what kind of physical chemistries are utilized in the life sciences using many schematic diagrams and movies.</p> <p>Contents : The contents are as follows.</p> <ol style="list-style-type: none"> 1. Molecular Dynamics Simulation? Visualizing Molecules on Computer? 2. Fluorescent Proteins and Probes in Life Science 3. Microscopy and Single-Molecule Analysis ?Visualizing Molecules in Experiment? 4. Watching Protein Action on DNA 5. Liquid-Liquid Phase Separation? Condensation Magic? 6. Rational and Experiment-Guided Peptide Design for Disease-Related Proteins <p>This course is centered on a lecture.</p> <p>Books required/referenced : Slides which I prepared are used in this class.</p> <p>Preparation and review : The session time is limited and therefore self-directed learning is important.</p> <p>Grading : A minute paper with attendance in each class is evaluated.</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Polymer Chemistry I (高分子化学 I)	6th Semester 1 Credit	和田 健彦	Laboratory of Nanobio Functional Materials/Chemical Biology & Supramolecular Photochirogenesis
<p>Course code/number : SCH-OCH301E</p> <p>Course Title : Polymer Chemistry I</p> <p>Purpose/Abstract :</p> <p>The category of polymer (or macromolecular) materials is so wide, for example, familiar fiber (or textile), rubber, plastics, and photo-resist to fabricate semiconductor integrated circuit (IC). Protein and nucleic acid are also a kind of polymer, so-called biopolymer.</p> <p>In this lecture, synthesis, structure, and properties of polymers will be first introduced, which is considerably different from the case of ordinary organic low-molecular weight compounds. Next, high-performance and functional polymers, and hybrid polymer materials will be explained in detail. In addition, biopolymer will be summarized from the viewpoint of biophysics.</p> <p>Goal :</p> <p>Aiming at making the backbone in the specific fields of advanced materials science in nano-science and nano-technology through basic understanding for polymer material chemistry.</p> <p>Contents :</p> <ol style="list-style-type: none"> (1) Basic Principles (2) Molecular Weight and Polymer Solutions. (3) Chemical Structure and Polymer Morphology (4) Chemical Structure and Polymer Properties (5) Evaluation, Characterization and analysis of Polymers. <p>Books required/referenced :</p> <p>"Polymer Chemistry — An Introduction—" (3rd Ed.) by Malcolm P. Stevens, Oxford Univ., Press, NY, 1999.</p> <p>Preparation and review :</p> <p>The session time is limited and therefore self-directed learning is important. Students are required to review for each class.</p> <p>Grading :</p> <p>Attendance and regular examination</p> <p>Remarks :</p>			

Course	Semester/Credits	Instructor	Affiliation
Organic Chemistry I A (有機化学 I A)	6th Semester 1 Credit	BREEDLOVE BRIAN	Laboratory of Nanomaterials
<p>Course code/number : SCH-ORG301E</p> <p>Course Title : Organic Chemistry IA (AMC)</p> <p>Purpose/Abstract :</p> <p>Since organic, coordination, inorganic, bio and materials chemistries all require the ability to use spectroscopy to characterize molecules. This course will provide students tools needed to interpret spectra from different spectroscopic techniques.</p> <p>Goal :</p> <p>Students should be able to characterize organic compounds from the spectra from various techniques, including NMR, IR, UV-vis, etc.</p> <p>Contents :</p> <p>The course will contain the following :</p> <ol style="list-style-type: none"> 1. IR and UV-vis spectroscopy and mass spectrometry 2. ¹H NMR spectroscopy 3. ¹³C NMR spectroscopy 4. 2D NMR techniques <p>Books required/referenced :</p> <p>Texts will be discussed in class.</p> <p>Preparation and review :</p> <p>do the practice problems</p> <p>Grading :</p> <p>practice problems and one exam</p> <p>Remarks :</p> <p>breedlove.brian.b1@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
Biochemistry II A (生物化学 II A)	6th Semester 1 Credit	松井 敏高	Cell Functional Molecular Chemistry
<p>Course code/number : SCH-BIC301E</p> <p>Course Title : Biochemistry of nucleic acid and protein synthesis.</p> <p>Purpose/Abstract : To learn the biological phenomena at the molecular level and to gain a deeper understanding of biochemistry, molecular biology and biophysics. It is desirable to consistently attend the discussions in Biochemistry II B concerning the photosynthesis, protein turnover and protein trafficking.</p> <p>Goal : Students will gain an understanding of the various biological phenomenon related to synthesis of nucleic acids and proteins.</p> <p>Contents : The lectures will cover chapters 28 to 32 of the textbook. 1st class DNA replication, repair and recombination I 2nd class DNA replication, repair and recombination II 3rd class RNA synthesis and processing I 4th class RNA synthesis and processing II 5th class Protein synthesis 6th class The control of gene expression in prokaryotes 7th class The control of gene expression in eukaryotes including practical approach for heterologous protein expression</p> <p>Books required/referenced : Berg, Tymoczko and Stryer, Biochemistry (Freeman and Co. NY). The 8th edition is available but the chapter numbers are based on the 7th edition.</p> <p>Preparation and review : Students are required not only to submit class assignments but also to review each class using handouts. If there remain any parts they cannot understand, they should ask questions in the next class.</p> <p>Grading : The results of examinations and attendance will be taken into consideration for evaluation.</p> <p>Remarks : The contact addresses of Toshitaka Matsui are as follows : Office : South Multidisciplinary Research Laboratory Building 1, room 607 (Katahira Campus). Office hour : Tuesday from 1 :00pm to 3 :00pm. Email : toshitaka.matsui.d5@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
Biochemistry II B (生物化学 II B)	6th Semester 1 Credit	門倉 広	Laboratory of Biomolecular Structure, IMRAM
<p>Course code/number : SCH-BIC302E</p> <p>Course Title : 生物化学 II B</p> <p>Purpose/Abstract : To learn the biological phenomena at the molecular level and to gain a deeper understanding of biochemistry, molecular biology and biophysics.</p> <p>Goal : Students will understand the principles and basic mechanisms of photosynthesis, protein turnover and protein trafficking.</p> <p>Contents : 1. Light reactions of photosynthesis I 2. Light reactions of photosynthesis II 3. Calvin cycle and the pentose phosphate pathway 4. Protein turnover and amino acid metabolism 5. Intracellular compartments and transport I 6. Intracellular compartments and transport II 7. Final exam The lectures will be interactive.</p> <p>Books required/referenced : Handouts will be provided. For further studies, use the following text books: 1. Berg, Tymoczko, Gatto, and Stryer, Biochemistry, international edition (WH Freeman). 2. Alberts, Hopkin, Johnson, Morgan, Raff, Roberts, and Walter, Essential Cell Biology (WW Norton & Co).</p> <p>Preparation and review : Some assignments may be given for better understanding.</p> <p>Grading : The final grade in this course will be based on the final exam, quizzes, attendance, and active participation.</p> <p>Remarks : The contact address of Hiroshi KADOKURA Office : Laboratory of Biomolecular Structure, IMRAM South Multidisciplinary Research Laboratory Building 1, Room 508, Katahira Campus Email : hiroshi.kadokura.b3@tohoku.ac.jp</p>			

Course	Semester/Credits	Instructor	Affiliation
Polymer Chemistry II (高分子化学 II)	6th Semester 1 Credit	和田 健彦	Laboratory of Nanobio Functional Materials/Chemical Biology & Supramolecular Photochirogenesis
<p>Course code/number : SCH-OCH302E</p> <p>Course Title : Polymer Chemistry II</p> <p>Purpose/Abstract :</p> <p>The category of polymer (or macromolecular) materials is so wide, for example, familiar fiber (or textile), rubber, plastics, and photo-resist to fabricate semiconductor integrated circuit (IC). Protein and nucleic acid are also a kind of polymer, so-called biopolymer.</p> <p>In this lecture, synthesis, structure, and properties of polymers will be first introduced, which is considerably different from the case of ordinary organic low-molecular weight compounds. Next, high-performance and functional polymers, and hybrid polymer materials will be explained in detail. In addition, biopolymer will be summarized from the viewpoint of biophysics.</p> <p>Goal :</p> <p>Aiming at making the backbone in the specific fields of advanced materials science in nano-science and nano-technology through basic understanding for polymer material chemistry.</p> <p>Contents :</p> <ol style="list-style-type: none"> (1) Free Radical Polymerization (2) Ionic Polymerization (3) Vinyl Polymerization with Complex Coordination Catalysts (4) Step-reaction and Ring-opening Polymerization <p>Books required/referenced :</p> <p>"Polymer Chemistry — An Introduction—" (3rd Ed.) by Malcolm P. Stevens, Oxford Univ., Press, NY, 1999.</p> <p>Preparation and review :</p> <p>The session time is limited and therefore self-directed learning is important. Students are required to review for each class.</p> <p>Grading :</p> <p>Attendance and regular examination</p> <p>Remarks :</p>			