Subject Code	SD21100013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Seminar in Creative Molecular Science		
Subject Number	SBCMS1701		
Credits	2Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to learn current research topics in the field of creative molecular science to gain an overview of developments in this field.		
Goal of the Subject	The goals of this course will be informed at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be introduced in the class.		
Remarks1			

Subject Code	SD21110013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Seminar in Functional Molecular Science		
Subject Number	SBFMS1701		
Credits	2Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to learn current research topics in the field of functional molecular science to gain an overview of developments in this field.		
Goal of the Subject	The goals of this course will be informed at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be introduced in the class.		
Remarks1			

Subject Code	SD21120013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Leadership Training Program		
Subject Number	SBLTP1701		
Credits	2Credits	Teaching Method	Special Seminar
Main Lecturer	Masatoshi Kozaki		
Main Theme of the Subject	We will develop "leadership" and "communication" abilities based on real instructing experience by setting opportunities for practical educational experience at high school in which graduate students take the initiative.		
Goal of the Subject	Acquisition of education and practical skills through guidance of high school students aiming for presentation at the Grand Contest on Chemistry for High School Students.		
Contents of the Subject /Subject Plan	Students go to a high school (or a college of technology) where high school students (college students) is planning entry in Grand Contest on Chemistry for High School Students and teaches, consults and discusses research conducted by high school students (college students) in cooperation with high school teachers (college teachers). Additionally, students provide instruction from time to time by e-mail and telephone. Through these experiences, students will acquire leadership skills and communication skills practically.		
Preparation and Review	I will show students separately.		
Evaluation Method	Students will be evaluated based on student reports and high school teacher reports.		
Comments to Students	Review the undergraduate education of the university and the general chemistry learned in the previous doctoral program.		
Teaching Materials	none		
Remarks1			

Subject Code	SD21130013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Academic Exchange Study		
Subject Number	SBAES1701		
Credits	2Credits	Teaching Method	Special Seminar
Main Lecturer	Yoshio Teki		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to learn research fields that differ from their advanced research for doctoral thesis.		
Goal of the Subject	The goal of this course is for students to have the ability and the wide field of vision for the different research field from their advanced research for doctoral thesis or the interdisciplinary researches		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	Course contents will be provided at the beginning of the class.		
Evaluation Method	Grading will be based on reports and assessment of performance in the research or the seminar attended in the different fields from their advanced research for doctoral thesis.		
Comments to Students	Students are expected to attend actively to the research or the seminar.		
Teaching Materials	Guidance will be provided at the beginning of the class.		
Remarks1			

Subject Code	SD21140013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Interdisciplinary Planner TrainingProgram		
Subject Number	SBIPT1701		
Credits	2Credits	Teaching Method	Special Seminar
Main Lecturer	Toshiyuki Moriuchi		
Main Theme of the Subject	This class fosters interdisciplinary and international perspectives through short-term overseas dispatch and international research exchange.		
Goal of the Subject	The purpose of this class is to conduct short-term dispatch to overseas collaborative research laboratories, presentations and discussions at international conferences, discussions with foreign researchers invited at international seminars, etc. to foster international interdisciplinary researchers.		
Contents of the Subject /Subject Plan	(1) The teacher will do with consultation and confirmation of the applicant's hope and implementation plan with the supervising advisor. (2) Following the implementation plan, short-term stay at overseas collaborative research laboratories, presentations and discussions at international conferences, discussions with foreign researchers invited at international seminars, etc, will be carried out. (3) The student submits a report on the contents of the studies. (4) The teacher evaluates the submitted report from the viewpoint of the achievement level of the goal.		
Preparation and Review	It will be announced separately.		
Evaluation Method	The teacher evaluates the submitted report from the viewpoint of the achievement level of the goal.		
Comments to Students	We would like you to expand your perspective by actively participating.		
Teaching Materials	It will be announced separately.		
Remarks1			

Subject Code	SD23010013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Advanced Research Course for Doctoral Thesis of Science (D1)		
Subject Number	SBARC1701		
Credits	3Credits	Teaching Method	Seminar／Laboratory
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to help students cultivate the ability to organize an academic discipline by developing knowledge and experimental skills to conduct research projects as well as by improving peripheral science. Students are expected to cultivate leadership for younger students and to acquire the knowledge to act as an independent research leader. In addition, students are expected to develop the skill and ability to disseminate research findings in English.		
Goal of the Subject	The goals of this course are toObtain the highly advanced knowledge and skills for research experiments.Acquire communication and discussion skills in English by disseminating research findings to the world.Cultivate research leadership for undergraduate and Master's course students.Obtain the ability to solve problems and to set original research projects as an independent researcher.		
Contents of the Subject /Subject Plan	Students will belong to one of the following labs and do chemical research provided by a supervisor in each lab. Field of Physical Chemistry: Quantum Functionality Materials, Molecular Physical Chemistry, Photophysical Chemistry, Biophysical Chemistry Field of Organic Chemistry: Synthetic Organic Chemistry, Molecular Conversion, Physical Organic Chemistry, Organic Reaction Chemistry, Fine Organic Chemistry Field of Inorganic Chemistry: Advanced Analytical Chemistry, Bio-functional Molecular Design, Hybrid Molecular Chemistry, Function Chemistry Students are expected to (1) Set experimental plans on the basis of the research projects provided by their supervisors. Students are also encouraged to give younger students guidance in the study based on the research plan. (2) Understand the background and significance of the research projects by online information retrieval. Students will also be able to extend the research project. (3) Be able to summarize the research results and present them at at domestic and international meetings. (4) Acquire skills necessary for preparation and submission of research papers in scientific journals. (5) Pass cross-sectional research proposals (proposal defense).		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on assessment of a performance to the research subjects, publishing capability of the studies, and research leadership for undergraduate and Master's course students. Students must present their research results in the scientific meetings and to refereed academic journals. Students must pass the proposal defense.		
Comments to Students	To be announced separately.		
Teaching Materials	Students are required to use specialized books and academic journals, which are selected by themselves, supervisors, and lab's members.		
Remarks1			

Subject Code	SD23020013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Advanced Research Course for Doctoral Thesis of Science (D2)		
Subject Number	SBARC2801		
Credits	3Credits	Teaching Method	Seminar／Laboratory
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to help students cultivate the ability to organize an academic discipline by developing knowledge and experimental skills to conduct research projects as well as by improving peripheral science. Students are expected to cultivate leadership for younger students and to acquire the knowledge to act as an independent research leader. In addition, students are expected to develop the skill and ability to disseminate research findings in English.		
Goal of the Subject	The goals of this course are toObtain the highly advanced knowledge and skills for research experiments.Acquire communication and discussion skills in English by disseminating research findings to the world.Cultivate research leadership for undergraduate and Master's course students.Obtain the ability to solve problems and to set original research projects as an independent researcher.		
Contents of the Subject /Subject Plan	Students will belong to one of the following labs and do chemical research provided by a supervisor in each lab. Field of Physical Chemistry: Quantum Functionality Materials, Molecular Physical Chemistry, Photophysical Chemistry, Biophysical Chemistry Field of Organic Chemistry: Synthetic Organic Chemistry, Molecular Conversion, Physical Organic Chemistry, Organic Reaction Chemistry, Fine Organic Chemistry Field of Inorganic Chemistry: Advanced Analytical Chemistry, Bio-functional Molecular Design, Hybrid Molecular Chemistry, Function Chemistry Students are expected to (1) Set experimental plans on the basis of the research projects provided by their supervisors. Students are also encouraged to give younger students guidance in the study based on the research plan. (2) Understand the background and significance of the research projects by online information retrieval. Students will also be able to extend the research project. (3) Be able to summarize the research results and present them at at domestic and international meetings. (4) Acquire skills necessary for preparation and submission of research papers in scientific journals. (5) Pass cross-sectional research proposals (proposal defense).		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on assessment of a performance to the research subjects, publishing capability of the studies, and research leadership for undergraduate and Master's course students. Students must present their research results in the scientific meetings and to refereed academic journals. Students must pass the proposal defense.		
Comments to Students	To be announced separately.		
Teaching Materials	Students are required to use specialized books and academic journals, which are selected by themselves, supervisors, and lab's members.		
Remarks1			

Subject Code	SD23030013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Advanced Research Course for Doctoral Thesis of Science (D3)		
Subject Number	SBARC3901		
Credits	2Credits	Teaching Method	Seminar／Laboratory
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to help students cultivate the ability to organize an academic discipline by developing knowledge and experimental skills to conduct research projects as well as by improving peripheral science. Students are expected to cultivate leadership for younger students and to acquire the knowledge to act as an independent research leader. In addition, students are expected to develop the skill and ability to disseminate research findings in English.		
Goal of the Subject	The goals of this course are toObtain the highly advanced knowledge and skills for research experiments.Acquire communication and discussion skills in English by disseminating research findings to the world.Cultivate research leadership for undergraduate and Master's course students.Obtain the ability to solve problems and to set original research projects as an independent researcher.		
Contents of the Subject /Subject Plan	Students will belong to one of the following labs and do chemical research provided by a supervisor in each lab. Field of Physical Chemistry: Quantum Functionality Materials, Molecular Physical Chemistry, Photophysical Chemistry, Biophysical Chemistry Field of Organic Chemistry: Synthetic Organic Chemistry, Molecular Conversion, Physical Organic Chemistry, Organic Reaction Chemistry, Fine Organic Chemistry Field of Inorganic Chemistry: Advanced Analytical Chemistry, Bio-functional Molecular Design, Hybrid Molecular Chemistry, Function Chemistry Students are expected to (1) Set experimental plans on the basis of the research projects provided by their supervisors. Students are also encouraged to give younger students guidance in the study based on the research plan. (2) Understand the background and significance of the research projects by online information retrieval. Students will also be able to extend the research project. (3) Be able to summarize the research results and present them at at domestic and international meetings. (4) Acquire skills necessary for preparation and submission of research papers in scientific journals. (5) Pass cross-sectional research proposals (proposal defense).		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on assessment of a performance to the research subjects, publishing capability of the studies, and research leadership for undergraduate and Master's course students. Students must present their research results in the scientific meetings and to refereed academic journals. Students must pass the proposal defense.		
Comments to Students	To be announced separately.		
Teaching Materials	Students are required to use specialized books and academic journals, which are selected by themselves, supervisors, and lab's members.		
Remarks1			

Subject Code	SD40020033	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	International Advanced Research Course for Doctoral Thesis of Science 2		
Subject Number			
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to gain research experience abroad.		
Goal of the Subject	The goals of this course are to(1) Develop and achieve a dissertation research project of the doctoral course by the research experience abroad.(2) Join the scientific community of overseas students and researchers in the research field.		
Contents of the Subject /Subject Plan	Students will be advised about how to select the overseas university and research institute, how to plan a research project and experimental procedures, how to present the research results in English. Students are required to provide the research reports.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on assessment of the research progress and results. Your grade will also be decided based on the presentation and communication skills abroad.		
Comments to Students	Before registration of the course, students should be approved by their supervisors.		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21310011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Exploring MolecularChemistry 2		
Subject Number	SBEMC1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Yasuyuki Tsuboi		
Main Theme of the Subject	The course deals with topics of the synthetic methods, unique properties, diverseness, and responsivity of selected molecules and materials, which exist in large numbers. The aim of this course is to help students develop their creative thinking for key molecules and materials for the future.		
Goal of the Subject	The goals of this course will be informed at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be provided at the beginning of the class.		
Remarks1			

Subject Code	SM21410011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Integrated MolecularChemistry 2		
Subject Number	SBIMC1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Masatoshi Kozaki		
Main Theme of the Subject	to be contacted at appropriate occasion		
Goal of the Subject	Recent topics on integrated molecular chemistry are lectured as intensive lectures by experts from other universities.		
Contents of the Subject /Subject Plan	to be contacted at appropriate occasion		
Preparation and Review	to be contacted at appropriate occasion		
Evaluation Method	to be contacted at appropriate occasion		
Comments to Students	to be contacted at appropriate occasion		
Teaching Materials	to be contacted at appropriate occasion		
Remarks1			

Subject Code	SM21560011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Core Organic Chemistry		
Subject Number	SBORG1501		
Credits	2Credits	Teaching Method	Lecture
Main Lecturer	Masatoshi Kozaki		
Main Theme of the Subject	Materials synthesis is a basic academic discipline related to any science. The aim of this course is to provide an opportunity for students to learn the organic synthesis reactions and the selectivity of them required at a graduate course level .		
Goal of the Subject	The goals of this course are to understand the contents of synthetic reactions described in the organic chemistry journals.		
Contents of the Subject /Subject Plan	The lecture will be conducted according to the following contents. Exercises will be also held each time. (1) Effects of molecular orbitals on conformation (2) Organic synthesis reactions and their selectivity, substitution reaction (3) Organic synthesis reactions and their selectivity, addition reaction (4) Organic synthesis reactions and their selectivity, elimination reaction (5) Organic synthesis reactions and their selectivity, pericyclic reaction (6) Organic synthesis reactions and their selectivity, rearrangement and fragmentation (7) Exercises and its commentary (8) Electronic structure (9) Conjugated electron system, aromaticity (10) Molecular structure (stereoisomerism, molecular strain) (11) Molecular Assemblies (molecular recognition, molecular crystals) (12) Exam and its explanation (13) Chemical reaction theory (14) Organic chemical reaction (15) Exam and its explanation		
Preparation and Review	Students are required to review the contents of lectures and exercises carefully. Students are also required to submit a report.		
Evaluation Method	Grading will be based on assessment of exercises and submitted reports.		
Comments to Students	The students have to have learned organic chemistry at the level of Bachelor's degree.		
Teaching Materials	The teacher will distribute teaching materials according to lecture contents.Reference books: Eds: Ryoji Noyori et al. "Lectures in Graduate Course: Organic Chemistry I and II," Tokyo Kagaku Dojin etc.		
Remarks1			

Subject Code	SM21570011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Core Inorganic Chemistry		
Subject Number	SBING1501		
Credits	2Credits	Teaching Method	Lecture
Main Lecturer	Takanori Nishioka		
Main Theme of the Subject	By learning fundamental matters on molecular symmetry and group theory, students understand that the concept of symmetry can be applied to the construction of molecular orbitals and analysis of molecular vibrations. In addition, the basic transition metal - carbon bonds in organometallic chemistry are outlined, and the bonds between transition metal - main-group elements (Si, B, P, S, etc.) are explained.		
Goal of the Subject	Irrespective of inorganic chemistry and organic chemistry, transition metal complexes are now widely used. The aim of this course is a systematical acquirement of the basis for helping to understand the ideas and phenomena which are essential for handling transition metal complexes.		
Contents of the Subject /Subject Plan	1. Molecular Symmetry; Symmetry operations and symmetry elements 2. Molecular Symmetry; Assignment of point groups and character tables 3. Molecular Symmetry; Reduction of representation 4. Molecular Symmetry; Molecular vibrations 5. Molecular Symmetry; Projection operators 6. Molecular Symmetry; Construction of molecular orbitals 7. Molecular Symmetry; Midterm exam and commentary 8. Transition metal complex with group 14 element ligand(s); silyl complex 9. Transition metal complex with group 14 element ligand(s); h2-silane, silylene complex 10. Transition metal complex with group 14 element ligand(s); Si-containing three membered metallacycle complex, silyl-bridged multi-nuclear complex 11. Transition metal complex with group 13 element ligand(s); M-B complex 12. Transition metal complex with group 13 element ligand(s); M-E complex (E = Al, Ga, In, Tl) 13. Transition metal complex with group 15 element ligand(s) 14. Transition metal complex with group 16 element ligand(s) 15. Term-end exam and commentary		
Preparation and Review	Handouts for each lecture will be distributed. Be sure to confirm the contents in advance of the class. After lecture, students should summarize the points of the lecture by themselves and solve designated exercises one by one.		
Evaluation Method	Normal point (short test) 10%, test (midterm and term-end exams) 90%.		
Comments to Students	Before the class, students are required to review “inorganic chemistry course” learned in undergraduate education of the university.		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21580011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Core Physical Chemistry		
Subject Number	SBPHY1501		
Credits	2Credits	Teaching Method	Lecture
Main Lecturer	Kazunobu Sato		
Main Theme of the Subject	Quantum physical chemistry and spectroscopy are essential for students in chemistry to understand modern molecular materials science. In this class, the students will learn the foundations of the modern physical chemistry and molecular spectroscopy. Through studying basic knowledge in physical chemistry, they will acquire abilities to apply its skill to develop the materials science.		
Goal of the Subject	The goal of this class is to learn the foundations of modern physical chemistry and molecular spectroscopy in order to study and develop the molecular materials science.		
Contents of the Subject /Subject Plan	1. Introduction of quantum theory 2. Foundations of quantum theory 3. Time-dependent quantum mechanics and chemistry 4. Atomic spectrum and electronic structure 5. Quantum theory of chemical bonding 6. Molecular electronic structures and MO theory 7. Introductory density functional theory 8. VUV Chemistry: Introduction 9. VUV Chemistry: Rydberg State 10. X-ray Chemistry: Introduction 11. X-ray Chemistry: XPS 12. X-ray Chemistry: XRF 13. X-ray Chemistry: XAFS 14. Electron Beam Chemistry: TEM, EDS, EELS		
Preparation and Review	Please take enough time to prepare and review for the class based on the distributed materials and scientific papers recommended.		
Evaluation Method	A grade will be evaluated based on the reports submitted.		
Comments to Students	We hope the students learn the foundations of quantum physical chemistry and molecular spectroscopy, and acquire knowledge and abilities to apply skills to develop their own research.		
Teaching Materials	Additional lecture materials are given in the class. The materials in the 8-14th lectures will be available from the web site, www.laserchem.jp.		
Remarks1			

Subject Code	SM21590011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Creative Molecular Science		
Subject Number	SBCMS1501		
Credits	2Credits	Teaching Method	Lecture
Main Lecturer	Yoshio Teki		
Main Theme of the Subject	Quantum mechanics and electronic state theory are essential to understand the properties of molecular substances in the field of molecular science.The first half of this class covers basics of the magnetic properties (magnetism) of molecular substances and methods to study electronic states of the molecules, where magnetic susceptibility measurement and ESR (including time-domain ESR) spectroscopy will be topics of the methods.The latter half lectures deals with the basis of main group element from the viewpoint of organic chemistry. The property, structure, and reactivity of heavier main group elements will be discussed include the property of related elements.		
Goal of the Subject	In the first half of the class, students are supposed to understand the basics of magnetism, origin of magnetism based on quantum theory, exchange interaction, and electron spin resonance spectroscopy through reviewing and establishing related knowledge with the class learned in the undergraduate course.The latter half, students are supposed to understand the characteristics of heavier main group elements, and apply theories to find new reaction and/or materials.		
Contents of the Subject /Subject Plan	1st. Origin of magnetism, electron spin, Zeeman interaction and Larmor frequency, diamagnetism 2nd. Paramagnetism of localized electrons and Curie's law, a method to measure magnetic susceptibility 3rd. Paramagnetism of conduction electrons 4th Exchange interaction and its origin, basics of molecular magnetism (organic magnetic material) 5th Weiss's molecular field approximation and Curie-Weiss rule, ferromagnetism, antiferromagnetism 6th Ferrimagnetic materials and antiferromagnetic materials 7th Basics of electronic spin resonance and advanced electron spin resonance (time domain measurement) methods 8th Properties of heavier main elements 9th Low-coodinated compounds of heavier main elements: Synthesis, structure and reaction of unsaturated compounds 10th Low-coodinated compounds of heavier main elements: Synthesis, structure and reaction of divalent compounds 11th High-coodinated compounds of heavier main elements: Synthesis, structure and reaction 12th Function of compounds heavier main elements: π conjugated systems 13th Typical reactions of organosilicon compounds 14th Applications of origosilanes and polysilanes 15th Application for electric materials		
Preparation and Review	Students are encouraged to review and understand the contents of lecture prior to the next lecture.		
Evaluation Method	The score of the class is evaluated comprehensively from the marks given for class participation and achievements of homework report and problems.		
Comments to Students	Prior to the first half, reviewing thermodynamics, quantum theory, magnetic resonance learned in the undergraduate course is highly encouraged.Prior to the latter half, reviewing inorganic chemistry in the undergraduate course is highly encouraged. It al		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21600011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Functional Molecular Science		
Subject Number	SBFMS1501		
Credits	2Credits	Teaching Method	Lecture
Main Lecturer	Toshiyuki Moriuchi		
Main Theme of the Subject	Recent progress and prospects of functional molecular system including supramolecular chemistry based on function design are discussed. Especially, design of functional molecular system for molecule catalysts, functional materials, and redox systems is described. Comparison with biological systems is also mentioned. The importance of these functional molecular systems in future functional chemistry is introduced. The latter half lectures are aimed to explain the principles of time-resolved and spatially resolved spectroscopy as a methodology for understanding the molecular reaction dynamics of functional molecules, and to understand the basics of experimental techniques.		
Goal of the Subject	The goal of this course is to understand the fundamental concept and knowledge of redox properties, assembling properties, biophysical function, chirality organization, structural control, and coordination programming for the design of functional molecular systems. The latter half starts to understand the basics of the interplay between light and matter, and to learn the principles and applications of time-resolved spectroscopy using ultra-short pulsed laser and space-resolved spectroscopy using a microscope.		
Contents of the Subject /Subject Plan	1: Functional Molecular System based on Hydrogen Bond 2: Functional Molecular System by using Self-Assembling Properties of Amino Acids 3: Functional Molecular System by using Self-Assembling Properties of Nucleobases 4: Redox Switching System 5: Coordination Programming System 6: Control of Functional Properties of Functional Molecular System 7: Host-Guest Chemistry 8: Determination of Chemical Reaction Stoichiometry 9: Principles of Optics 10: Fundamentals of the Interaction between Light and Molecules 11: Characteristics of Photochemical Reaction 12: Photophysicochemical Processes 13: Time-Resolved Spectroscopy using Ultra-short Pulsed Laser 14: Principles of Micro-spectroscopy 15: Micro-spectroscopy and its Application into Biological Systems		
Preparation and Review	At the end of each class, the content to be handled in the next week's lecture will be shown.		
Evaluation Method	Grading will be decided based on usual performance score (attitude in the class, quizzes) (20%) and Reports (80%).		
Comments to Students	We would like you to expand your perspective by actively participating.		
Teaching Materials	Teaching materials will be provided in the class.		
Remarks1			

Subject Code	SM21610011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Creative Advanced Organic Chemistry I		
Subject Number	SBCOR1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Tetsuya Satoh		
Main Theme of the Subject	This course introduces basic transition metal-catalyzed reactions, which have become one of the most important methods in the synthesis of functional organic molecules. The reactions using palladium catalysts, which are most widely used for organic synthesis, will be described, and then cross-coupling reaction and the recent topics of direct functionalization of carbon-hydrogen bonds will also be described.		
Goal of the Subject	Functional organic molecular science is an academic field aiming at the development of new reaction methods and the creation of functional substances related to general physical properties involving bio-related materials on the basis of molecular transformation and synthesis. This course deals with transition metal-catalyzed reactions such as cross coupling, which has become an indispensable reaction in contemporary functional molecule synthesis. The goal of this course is to understand the basic organometallic chemistry and the mechanism of catalytic reactions.		
Contents of the Subject /Subject Plan	1. Organometallic Chemistry 2. Chemistry on Palladium 3. Cross-Coupling: Background and Insight 4. Cross-Coupling: Application 5. Oxidative Coupling 6. C-H Activation: Background 7. C-H Activation: Mechanism 8. Exam and Elucidation		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be decided based on usual performance score (attitude in class, quizzes)(30%) and Exam (70%).		
Comments to Students	To be announced separately.		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21640011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Creative Advanced Inorganic Chemistry I		
Subject Number	SBCIN1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Masumi Itazaki		
Main Theme of the Subject	The basic transition metal - carbon bonds in organometallic chemistry are outlined. In addition, students will gain knowledge on catalytic cycles through organometallic reaction mechanisms and synthetic chemical applications of transition metal hydrides, carbonyls, carbene, alkenes, and alkyne complexes.		
Goal of the Subject	Irrespective of inorganic chemistry and organic chemistry, organometalic complexes are now widely used. The aim of this course is a systematical acquirement of the basis and synthetic applications for helping to understand the ideas and phenomena which are essential for handling organometalic complexes .		
Contents of the Subject /Subject Plan	1: Formalisms, Electron Counting, and Bonding 2: Organometallic Reaction Mechanisms 3: Synthetic Applications of Transition Metal Hydrides 4: Synthetic Applications of Complexes Containing Metal-Carbon s-bonds 5: Synthetic Applications of Transition Metal Carbonyl Complexes 6: Synthetic Applications of Transition Metal Carbene Complexes 7: Synthetic Applications of Transition Metal Alkene, Diene, and Dienyl Complexes 8: Synthetic Applications of Transition Metal Alkyne Complexes		
Preparation and Review	Handouts for each lecture will be distributed. Be sure to confirm the contents in advance of the class. After lecture, students should summarize the points of the lecture by themselves and solve designated exercises one by one.		
Evaluation Method	Grading will be decided based on usual performance score (attitude in class, quizzes)(20%) and Reports (80%).		
Comments to Students	Before the class, students are required to review “inorganic chemistry course” and “organometallic chemistry course" learned in undergraduate education of the university.		
Teaching Materials	The teacher will distribute teaching materials according to lecture contents.Reference books: By (author) Louis S. Hegedus "Transition Metals in the Synthesis of Complex Organic Molecules, 2nd Edition " Tokyo Kagaku Dojin etc.		
Remarks1			

Subject Code	SM21670011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Creative Advanced Physical Chemistry I		
Subject Number	SBCPH1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Kenji Sakota		
Main Theme of the Subject	Spectroscopy using the interaction of light and molecules is one of the basic analytical methods to observe microscopic view of molecules. In this lecture, we focus on the most basic one-photon process of the light-molecule interaction. First, we explain the principles of quantum mechanics necessary to understand one-photon processes, and then we explain how one-photon processes are described using quantum mechanics.		
Goal of the Subject	The quantum mechanical principle behind the interaction of light and molecules can be explained. The absorption and emission of light can be explained on the basis of quantum mechanical principles.		
Contents of the Subject /Subject Plan	1. Review of quantum mechanics and quantum chemistry learned at undergraduate course 2. Quantum mechanics described by bracket 3. Principles of quantum mechanics 4. Logic of quantum mechanics 5. Time-dependent perturbation theory (Fermi's golden rule) 6. Quantum theory of light absorption and emission: Part 1 7. Quantum theory of light absorption and emission: Part 2 8. Effect of optical resonator on spontaneous emission of molecules		
Preparation and Review	Review the logical development of the lecture so that you can reconstruct it yourself. Students are also required to submit reports on exercises.		
Evaluation Method	Grading will be based on evaluation of active participation in classes and submitted reports.		
Comments to Students	Review the contents of molecular spectroscopy and quantum chemistry learned at the undergraduate course. I will write mathematical formulas on the board so that there are no gaps, but try to derive them by yourself.		
Teaching Materials	Review the contents of molecular spectroscopy and quantum chemistry learned at the undergraduate course. I will write mathematical formulas on the board so that there are no gaps, but try to derive them by yourself.		
Remarks1			

Subject Code	SM21700011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Creative Advanced Molecular Science		
Subject Number	SBCMS1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Kazuo Toyota		
Main Theme of the Subject	The aim of this course is to learn basic principles and practical applications of quantum chemical calculation. The course covers the Hartree-Fock method and different levels of electron-correlation methods, for example, MPx, CI, CC, and DFT.		
Goal of the Subject	On completion of the course, the student shall be able to account for the basic principles behind the methods addressed in this course, account for the advantages and disadvantages of them, and choose appropriate basis set and theoretical model for desired type of calculation.		
Contents of the Subject /Subject Plan	(1) Independent particle model: Molecular orbital (MO), Slater determinant, and the Hartree-Fock theory. (2) Variational and non-variational approaches to electron correlation effects. (3) Configuration interaction (CI) and coupled cluster (CC) methods. (4) Density functional theory (DFT). Hohenberg-Kohn theorem and the Kohn-Sham DFT method. (5) Excited states and open-shell systems. (6) Energy derivatives. Geometry optimization and molecular properties. (7) Recent topics on electronic structure theory.		
Preparation and Review	Students are encouraged to enough time to prepare and review for the class. Read the distributed materials prior to each lecture.		
Evaluation Method	Students are required to submit a report.		
Comments to Students	The basic knowledge of quantum mechanics and linear algebra would be helpful to understand the lecture.		
Teaching Materials	Teaching materials will be provided in the class.		
Remarks1			

Subject Code	SM21710011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Functional Advanced Organic Chemistry I		
Subject Number	SBFOR1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Tetsuro Shinada		
Main Theme of the Subject	We set a target organic molecule for our researches and plan the synthetic route. In this class, knowledges to assemble molecules is discussed. The recent papers on the total synthesis of natural products will be picked up as a teaching material. We read the recent papers in English in turn and discuss the new chemistry. Retrosynthetic analysis of a natural product is examined by students. The proposal is discussed.		
Goal of the Subject	1) Learning the sense of retrosynthetic analysis. 2) Learning the reactions mechanism and selectivity. 3) Improving the skill to read the recent papers in English.		
Contents of the Subject /Subject Plan	1) Total synthesis of terpenoids. 2) Discussion and explanation about the topic 1). 3) Total synthesis of alkaloids. 4) Discussion and explanation about the topic 3). 5) Total synthesis of peptide natural products. 6) Discussion and explanation about the topic 5). 7) Retrosynthetic planning and presentation.		
Preparation and Review	1) Fundamental knowledges in synthetic organic chemistry and reaction mechanism. 2) Preparation for reading the paper.		
Evaluation Method	1) The activity for discussion (50%) 2) Presentation in English		
Comments to Students	To be announced separately.		
Teaching Materials	Recent papers on the synthetic chemistry will be provided.		
Remarks1			

Subject Code	SM21770011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Functional Advanced Physical Chemistry I		
Subject Number	SBFPH1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Harukazu Yoshino		
Main Theme of the Subject	This subject is aimed to develop the students' skill of making an elementary code of molecular orbital calculations to utilize the modern and powerful software like Gaussian more effectively. For this, they will also learn the knowledge on the mathematics, algorithms of numerical calculations, and the way of coding with a language Python, which is widely used to develop the artificial intelligence (AI). The skill of coding will also help the students to utilize AI's for their studies in the near future.		
Goal of the Subject	The students are required to have the following skills. — Understanding the principle of the extended Hückel molecular orbital (MO) calculations. — Understanding the related mathematical topics. — Using Python to make elementary codes for scientific calculations. — Understanding the algorithms to carry out the MO calculations on a computer.		
Contents of the Subject /Subject Plan	1: Installation of Python and its basic commands 2: Principle of extended Hückel calculations, Slater type orbitals 3: Coordinate conversion, multiple integration and Jacobian, numerical integration 4: Overlap integrals, normalization of atomic orbitals 5: Hamiltonian matrix, inverse matrix, multiple of matrices 6: Eigenproblem, diagonalization of matrix, eigenenergy and coefficient matrix 7: HOMO and LUMO, sorting data, file input/output 8: Application to inorganic and organic molecules		
Preparation and Review	Each student needs to join the class bringing his/her own PC with Windows 10. It will be better for the students to have basic knowledge on the quantum chemistry like the LCAO approximation in advance.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	Learning a programming language is similar to learning how to ride a bike. You can live without them. You need a lot of effort to become capable of using them. But you can enjoy your life much better with them than without.		
Teaching Materials	Teaching materials will be provided at WebClass and/or at the followig URL. http://e.sci.osaka-cu.ac.jp/yoshino/edu/lecture2.shtml (currently Japanese only)		
Remarks1			

Subject Code	SM21820011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Creative OrganicChemistry 2		
Subject Number	SBCSO1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Tetsuro Shinada		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to deeply understand organic chemistry from the intensive lectures focusing on solid organic chemistry, bioorganic chemistry, synthetic organic chemistry, organometallic chemistry, organic reaction chemistry, and polymer chemistry, which will be provided by the experts in each area.		
Goal of the Subject	The goals of this course will be informed at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be provided at the beginning of the class.		
Remarks1			

Subject Code	SM21840011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Creative InorganicChemistry 2		
Subject Number	SBCSI1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Hiroyuki Miyake		
Main Theme of the Subject	The objective of this class is to introduce a wide variety of leading-edge areas related to inorganic chemistry, such as inorganic solids materials, metal complexes, organometallic catalysts and open shell metal clusters associated with emerging spin technologies. Basics and recent progresses of a selected topic will be given by an invited expert of the field. This class is offered as an intensive course.		
Goal of the Subject	Students will acquire knowledge on the leading edge of inorganic chemistry introduced in this class. The application of acquired knowledge to their ongoing research projects are also encouraged.		
Contents of the Subject /Subject Plan	Course contents will be introduced at the beginning of semester.		
Preparation and Review	Lecture materials will be delivered at the beginning of the class. Students are encouraged to review the materials after finishing the class.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	Participate actively to broaden your knowledge on the leading edges in inorganic chemistry.		
Teaching Materials	Lecture materials will be delivered at the beginning of the class.		
Remarks1			

Subject Code	SM21860011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Selected Topics in Creative PhysicalChemistry 2		
Subject Number	SBCSP1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Daisuke Shiomi		
Main Theme of the Subject	This seminar is given by an invited researcher, who is an expert in physical chemistry and chemical physics of functional molecules in the solid state. The course covers some topics of molecule-based physical properties and physical measurement methods particularly for magnetically interacting molecular systems. The detailed topics will be announced separately.		
Goal of the Subject	The goals of this course will be provided at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be announced at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	To be announced separately.		
Comments to Students	To be announced separately.		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21880011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Functional OrganicChemistry 2		
Subject Number	SBFSO1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Tetsuya Satoh		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to understand structural analysis and synthetic methodologies of biofunctional, photoresponsive, and electron transfer materials. This course also deals with modern concepts for the synthesis of functional materials by way of fine chemistry and molecular aggregation.		
Goal of the Subject	The goals of this course will be informed at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	The contents for before and after learning will be provided at the beginning of the class.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	Comments to the students will be announced at the beginning of the class.		
Teaching Materials	Teaching materials will be provided in the class.		
Remarks1			

Subject Code	SM21900011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Selected Topics in Functional Inorganic Chemistry 2		
Subject Number	SBFSI1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Hiroshi Nakajima		
Main Theme of the Subject	This class focuses on inorganic functional materials which have been rapidly developing recent years. Fundamental concepts and recent progress in the field of life sciences and materials sciences will be discussed. Lectures of this intensive course will be given by specialists.		
Goal of the Subject	Students will learn the fundamental concept and knowledge of redox properties, assembling properties, biophysical function, chirality organization, structural control, and coordination programming for the design of functional inorganic chemistry.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	Course contents will be provided at the beginning of the class.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	We would like you to expand your perspective by actively participating.		
Teaching Materials	Teaching materials will be provided in the class.		
Remarks1			

Subject Code	SM21920011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Selected Topics in Functional PhysicalChemistry 2		
Subject Number	SBFSP1502		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Kenji Sakota		
Main Theme of the Subject	This is a seminar given by an invited researcher, who is studying functional molecules and/or their condensed states at the frontier of Physical Chemistry and related fields. The topics and its details will be announced separately since they change every year depending on the lecturer.		
Goal of the Subject	It is getting more and more important to organize various physical and chemical methods of measurements, calculations, and theories to characterize novel functional molecules and their condensed states. In this seminar, the students are expected to learn the expertise in Physical Chemistry and related fields to understand recent studies on the functional materials.		
Contents of the Subject /Subject Plan	To be announced separately.		
Preparation and Review	To be announced separately.		
Evaluation Method	To be announced separately.		
Comments to Students	This seminar is given by a leading expert in Physical Chemistry and related fields. Different lecturers have been providing their original topics every year. Students are expected to learn not only the recent results on their studies and basic knowledge		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21970011	Offering Academic Year/Semester	2020Year First Semester
Subject Name(English)	Functional Advanced BiophysicalChemistry I		
Subject Number	SBFBI1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Yutaka Amao		
Main Theme of the Subject	In this lecture, basic theoretical analysis and experimental methods of photochemical reactions are outlined on the subject of photosynthetic reactions. From the photoochemical/physical point of view, the light harvesting, energy/electron transfer and catalysis processes are explained.		
Goal of the Subject	Green plants and photosynthetic bacteria grow by photosynthetic reactions utilizing light energy. Looking at the photosynthetic reaction in detail, it includes many subjects based on physical chemistry such as the light harvesting, energy/electron transfer and catalysis processes. In this lecture, physical chemistry point of view from light energy harvesting to catalysis mechanism by using photosynthetic reaction as a subject are learned.		
Contents of the Subject /Subject Plan	1) Experimental method for photochemical reaction 1 (Theoretical analysis) 2) Experimental method for photochemical reaction 2 3) Light energy and electron transfer processes in photosynthetic reaction 4) Experimental analysis method of photosynthetic reaction 5) Theories of photosynthetic reaction 1 (light harvesting processes) 6) Theories of photosynthetic reaction 2 (charge separation processes) 7) Theories of photosynthetic reaction 3 (catalytic processes)		
Preparation and Review	Distribute the lecture materials before the start of the lecture. It is recommended to understand the contents of the lecture material before each lecture.		
Evaluation Method	Evaluate by report.		
Comments to Students	In the lecture, light energy conversion processes on the photosynthesis are outlined. Lectures will be given to comprehensively understand from theory to experimental methods.		
Teaching Materials	Distribute the lecture materials before the start of the lecture.		
Remarks1			

Subject Code	SM23110011	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	International Seminar		
Subject Number	SBISE1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to develop world-class talent through international lectures in English provided by the overseas researchers.		
Goal of the Subject	The goal of this course is to develop communication ability in English useful for succeeding in international activities.		
Contents of the Subject /Subject Plan	Students are required to attend international lectures assigned as International Seminar four times or more and to pass an exam.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be provided in the class.		
Remarks1			

Subject Code	SM23130011	Offering Academic Year/Semester	2020Year Second Semester
Subject Name(English)	Functional Advanced Inorganic Chemistry I		
Subject Number	SBFIN1501		
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Masumi Itazaki		
Main Theme of the Subject	In the first half of the class, students are supposed to understand the basics and origin of molecular recognition chemistry, and key chemical concepts of molecular design to create new functional materials.		
Goal of the Subject	The half of this course aims to students are expected to explain the theory of molecular recognition.		
Contents of the Subject /Subject Plan	1st. Molecular recognition : history and current situation 2nd. Molecular recognition : molecular design, and molecule/ion recognition 3rd. Supramolecular chemistry 4th Application for functional materials		
Preparation and Review	To be announced separately.		
Evaluation Method	To be announced separately.		
Comments to Students	To be announced separately.		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM24130013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Exercises in Creative Molecular Science（M1）		
Subject Number	SBCMS1503		
Credits	4Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to review and introduce current research articles in the field of creative molecular science to gain an overview of developments in this field. Students will also report on progress of individual research projects and discuss it with supervisors and the group members.		
Goal of the Subject	The goals of this course are to(1) Gain a deeper understanding of creative molecular science.(2) Obtain broad expertise and leading-edge research methods of molecular construction by solving problem sets, experimental training, and reviewing research articles.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be introduced in the class.		
Remarks1			

Subject Code	SM24140013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Exercises in Creative Molecular Science（M2）		
Subject Number	SBCMS1601		
Credits	4Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to review and introduce current research articles in the field of creative molecular science to gain an overview of developments in this field.　Students will also report on progress of individual research projects and discuss it with supervisors and the group members.		
Goal of the Subject	The goals of this course are to(1) Gain a deeper understanding of creative molecular science.(2) Obtain broad expertise and leading-edge research methods of molecular construction by solving problem sets, experimental training, and reviewing research articles.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be introduced in the class.		
Remarks1			

Subject Code	SM24150013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Exercises in Functional Molecular Science（M1）		
Subject Number	SBFMS1503		
Credits	4Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to review and introduce current research articles in the field of functional molecular science to gain an overview of developments in this field. Students will also report on progress of individual research projects and discuss it with their supervisors and the group members.		
Goal of the Subject	The goals of this course are to(1) Gain a deeper understanding of functional molecular science.(2) Acquire broad knowledge and leading-edge research methods of functional molecules by solving problem sets, experimental training, and reviewing research articles.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be introduced in the class.		
Remarks1			

Subject Code	SM24160013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Exercises in Functional Molecular Science（M2）		
Subject Number	SBFMS1601		
Credits	4Credits	Teaching Method	Seminar
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to review and introduce current research articles in the field of functional molecular science to gain an overview of developments in this field. Students will also report on progress of individual research projects and discuss it with their supervisors and the group members.		
Goal of the Subject	The goals of this course are to(1) Gain a deeper understanding of functional molecular science.(2) Acquire broad knowledge and leading-edge research methods of functional molecules by solving problem sets, experimental training, and reviewing research articles.		
Contents of the Subject /Subject Plan	Course contents will be provided at the beginning of the class.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on lab reports and assessment of performance in the seminar.		
Comments to Students	To be announced separately.		
Teaching Materials	Teaching materials will be informed at the beginning of the class.		
Remarks1			

Subject Code	SM24170013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Advanced Research Course for Master's Thesis of Chemistry I		
Subject Number	SBARC1501		
Credits	6Credits	Teaching Method	Seminar／Laboratory
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to help students acquire depth knowledge of the research process and skills for the design and conduct of advanced chemistry experiments on the basis of knowledge and experimental skills taken through an undergraduate course.		
Goal of the Subject	The goals of this course are toObtain the knowledge and skills to conduct experiments in a safe and scientific manner.Gain the skills and knowledge to conduct advanced chemistry researchAcquire communication and discussion skills in English by disseminating research findings to the world.Obtain the ability to utilize knowledge, to solve problems, and to set original research projects.		
Contents of the Subject /Subject Plan	Students will select one of the following labs and do chemical research provided by a supervisor in each lab. Field of Physical Chemistry: Quantum Functionality Materials, Molecular Physical Chemistry, Photophysical Chemistry, Biophysical Chemistry Field of Organic Chemistry: Synthetic Organic Chemistry, Molecular Conversion, Physical Organic Chemistry, Organic Reaction Chemistry, Fine Organic Chemistry Field of Inorganic Chemistry: Advanced Analytical Chemistry, Bio-functional Molecular Design, Hybrid Molecular Chemistry, Function Chemistry Students are expected to (1) Set experimental plans on the basis of the research projects provided by their supervisors. (2) Be able to understand the experimental results and to report them in a straightforward manner. Students will also be able to modify the experimental plans through discussion with supervisors and the lab's member. (3) Understand the background and significance of the research projects by online information retrieval. Students will also be able to extend the research project. (4) Take part in seminars, lecture meetings, and conferences, and be able to review the current research trends logically. (5) Be able to summarize the research results and present them at domestic and international meetings. Students are encouraged to publish articles in academic journals. (6) Be able to use reagents and experimental instruments safely.		
Preparation and Review	Students will obtain the knowledge and methods for experiments by literature research in advance. On the basis of the information, students are encouraged to plan experimental procedures and discuss them with their supervisors. The obtained experimental		
Evaluation Method	Grading will be based on assessment of an approach and performance to the research subjects, and publishing capability of the studies.		
Comments to Students	To be announced separately.		
Teaching Materials	Students are required to use specialized books and academic journals, which are selected by themselves, supervisors, and lab's members.		
Remarks1			

Subject Code	SM24180013	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	Advanced Research Course for Master's Thesis of Chemistry II		
Subject Number	SBARC1601		
Credits	6Credits	Teaching Method	Seminar／Laboratory
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to help students acquire depth knowledge of the research process and skills for the design and conduct of advanced chemistry experiments on the basis of knowledge and experimental skills taken through an undergraduate course.		
Goal of the Subject	The goals of this course are toObtain the knowledge and skills to conduct experiments in a safe and scientific manner.Gain the skills and knowledge to conduct advanced chemistry researchAcquire communication and discussion skills in English by disseminating research findings to the world.Obtain the ability to utilize knowledge, to solve problems, and to set original research projects.		
Contents of the Subject /Subject Plan	Students will select one of the following labs and do chemical research provided by a supervisor in each lab. Field of Physical Chemistry: Quantum Functionality Materials, Molecular Physical Chemistry, Photophysical Chemistry, Biophysical Chemistry Field of Organic Chemistry: Synthetic Organic Chemistry, Molecular Conversion, Physical Organic Chemistry, Organic Reaction Chemistry, Fine Organic Chemistry Field of Inorganic Chemistry: Advanced Analytical Chemistry, Bio-functional Molecular Design, Hybrid Molecular Chemistry, Function Chemistry Students are expected to (1) Set experimental plans on the basis of the research projects provided by their supervisors. (2) Be able to understand the experimental results and to report them in a straightforward manner. Students will also be able to modify the experimental plans through discussion with supervisors and the lab's member. (3) Understand the background and significance of the research projects by online information retrieval. Students will also be able to extend the research project. (4) Take part in seminars, lecture meetings, and conferences, and be able to review the current research trends logically. (5) Be able to summarize the research results and present them at domestic and international meetings. Students are encouraged to publish articles in academic journals. (6) Be able to use reagents and experimental instruments safely.		
Preparation and Review	Students will obtain the knowledge and methods for experiments by literature research in advance. On the basis of the information, students are encouraged to plan experimental procedures and discuss them with their supervisors. The obtained experimental		
Evaluation Method	Grading will be based on assessment of an approach and performance to the research subjects, and publishing capability of the studies.		
Comments to Students	To be announced separately.		
Teaching Materials	Students are required to use specialized books and academic journals, which are selected by themselves, supervisors, and lab's members.		
Remarks1			

Subject Code	SM40020033	Offering Academic Year/Semester	2020Year First Semester, 2020Year Second Semester
Subject Name(English)	International Advanced Research Coursefor Master's Thesis of Science 2		
Subject Number			
Credits	1Credit	Teaching Method	Lecture
Main Lecturer	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to gain research experience abroad.		
Goal of the Subject	The goals of this course are to(1) Develop and achieve a dissertation research project of the master's course by the research experience abroad.(2) Join the scientific community of overseas students and researchers in the research field.		
Contents of the Subject /Subject Plan	Students will be advised about how to select the overseas university and research institute, how to plan a research project and experimental procedures, how to present the research results in English. Students are required to provide the research reports.		
Preparation and Review	To be announced separately.		
Evaluation Method	Grading will be based on assessment of the research progress and results. Your grade will also be decided based on the presentation and communication skills abroad.		
Comments to Students	Before registration of the course, students should be approved by their supervisors.		
Teaching Materials	To be announced separately.		
Remarks1			