Subject Code	SM21300011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Selected Topics in Exploring Molecular Chemistry 1		
Subject Number	SBEMC1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Harukazu Yoshino,Masazumi Fujiwara		
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 m		
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	They will be announced before the biginning of the class.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	Comments will be provided at the biginning of the class.		
Teaching Materials	Teaching materials will be provided at the beginning of the class.		
Remarks1			

Subject Code	SM21560011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Core Organic Chemistry		
Subject Number	SBORG1501		
Credit(s)	2 Credits	Teaching Method	Lecture
Lecturer(s)	Masatoshi Kozaki,Kazuhiko Sakaguchi		
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 (10) Aromaticity (11) Molecular structure (stereoisomerism, molecular strain) (12) Molecular Assemblies (molecular recognition, molecular crystals) (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	2021 First Semester
Subject Name(English)	Core Inorganic Chemistry		
Subject Number	SBING1501		
Credit(s)	2 Credits	Teaching Method	Lecture
Lecturer(s)	Takanori Nishioka,Satoshi Shinoda		
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		
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		
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	2021 First Semester
Subject Name(English)	Core Physical Chemistry		
Subject Number	SBPHY1501		
Credit(s)	2 Credits	Teaching Method	Lecture
Lecturer(s)	Kazunobu Sato,Tomoyuki Yatsuhashi		
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. Throu		
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	2021 Second Semester
Subject Name(English)	Creative Molecular Science		
Subject Number	SBCMS1501		
Credit(s)	2 Credits	Teaching Method	Lecture
Lecturer(s)	Yoshio Teki,Eiko Mieda		
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		
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 w		
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		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21600011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Functional Molecular Science		
Subject Number	SBFMS1501		
Credit(s)	2 Credits	Teaching Method	Lecture
Lecturer(s)	Toshiyuki Moriuchi,Chie Hosokawa		
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 de		
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 molecula		
Contents of the Subject /Subject Plan	1: Host-Guest Chemistry 2: Determination of Chemical Reaction Stoichiometry 3: Redox Switching System 4: Functional Molecular System based on Hydrogen Bond 5: Functional Molecular System by using Self-Assembling Properties of Amino Acids and Arrhenius Equation 6: Functional Molecular System by using Self-Assembling Properties of Nucleobases and van't Hoff Equation 7: Coordination Programming System 8: Control of Functional Properties of Functional Molecular System (Control of Emission Properties and Halogen Bond) 9: Principles of Optics 10: Fundamentals of the Interaction between Light and Molecules I 11: Fundamentals of the Interaction between Light and Molecules II 12: Photochemical Reaction and Photophysicochemical Processes 13: Time-Resolved Spectroscopy 14: Space-Resolved Spectroscopy: 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) (10%) and Reports (90%).		
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	SM21620011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Creative Advanced Organic Chemistry II		
Subject Number	SBCOR1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Takahiro Nishimura		
Main Theme of the Subject	The aim of this course is to provide an opportunity for students to understand transition-metal-catalyzed asymmetric organic transformations. In particular, asymmetric synthesis involving C–C bond formation will be introduced.		
Goal of the Subject	On completion of the course, the student will be able to understand the following: (1) The structure and character of chiral ligands, (2) Asymmetric allylic substitution, (3) Asymmetric conjugate addition, (4) Asymmetric synthesis by way of desymmetrizati		
Contents of the Subject /Subject Plan	1. The structure and character of chiral ligands 2. Asymmetric allylic substitution: Pd catalysis 3. Asymmetric allylic substitution: Ir catalysis 4. Asymmetric conjugate addition: Cu catalysis 5. Asymmetric conjugate addition: Rh catalysis 6. Asymmetric addition of terminal alkynes 7. Asymmetric synthesis by way of desymmetrization 8. Asymmetric synthesis involving C-H activation		
Preparation and Review	Materials on lecture will be distributed before class. Students should confirm contents and come to class.		
Evaluation Method	Students will be comprehensively evaluated from quizzes and reports in class.		
Comments to Students	This lecture is suitable for students who are interested in basic organic transformations using transition-metal-catalysts.		
Teaching Materials	Teaching materials will be provided at the beginning of the class.		
Remarks1			

Subject Code	SM21650011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Creative Advanced Inorganic Chemistry II		
Subject Number	SBCIN1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Hiroyuki Miyake		
Main Theme of the Subject	This course aims to study molecular recognition chemistry which deals with weak interactions between molecules and self-assembly of molecules. Especially, structures and functions of supramolecules formed by non-covalent bonds including coordination bonds		
Goal of the Subject	The goals of this course are to (1) Understand the processes and analytic methods about the formation of ion and molecular complexes, (2) Be able to design molecules by using characteristic properties of various metal ions, (3) Understand the electroni		
Contents of the Subject /Subject Plan	1. Weak interactions between molecules and principles of molecular recognition 2. Molecular recognition based on coordination chemistry 3. Stereochemistry of metal complexes and supramolecular chemistry 4. Dynamic coordination chemistry and self-assembly 5. Examples of functional metal complexes 6. Characteristics of lanthanide ions and lanthanide coordination chemistry 7. Functions of lanthanide complexes and their applications 8. Recent topics on supramolecular coordination chemistry		
Preparation and Review	To be announced separately.		
Evaluation Method	class participation including short examinations (40%) submission of reports (60%)		
Comments to Students	This course deals with metal complexes, but mainly focus on general molecular recognition and supramolecular chemistry. In the latter half, lanthanide complexes are used as subjects.		
Teaching Materials	Jonathan W. Steed and Jerry L. Atwood, "Supramolecular chemistry, 2nd Ed.", Wiley Simon Cotton, "Lanthanide and actinide chemistry", Wiley		
Remarks1			

Subject Code	SM21680011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Creative Advanced Physical Chemistry II		
Subject Number	SBCPH1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Kazuo Toyota,Masazumi Fujiwara		
Main Theme of the Subject	Modern optical microscopy is a fundamental research tool to visualize dynamic motion of molecules and nanomaterials at nano/micro-scale, which are widely used in a broad scientific area of physics, chemistry and biology. In this lecture, we study the fund		
Goal of the Subject	Students understand basics of optics and the principle of optical microscope. They get familiar with a pure-classical methodology to study absorption/emission of molecules, in which the absorption/emission of molecules are treated as optical transmission		
Contents of the Subject /Subject Plan	1st Give an overview of the lecture and have a survey to know the level of students. 2nd Basics of optics and principles of microscope. 3rd Principles of confocal microscope. 4th Basics of electromagnetism. 5th Pure classical picture of absorption, scattering, and emission of molecules. 6th Single molecule (single nanoparticle) spectroscopy. 7th Some advanced applications of optical microscopy.		
Preparation and Review	Pre-study the educational material provided from the lecturer. Check the distributed materials (like original papers) after the lecture.		
Evaluation Method	Quality of the final report (50%) and active participation to the class (50 %).		
Comments to Students	Students need to review textbooks of physical chemistry and molecular spectroscopy of undergraduate level.		
Teaching Materials	Related documents and educational materials will be distributed. Reference: Novotony and Hecht, “Principles of Nano-Optics”(Cambridge University Press, 2012)		
Remarks1			

Subject Code	SM21720011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Functional Advanced Organic Chemistry II		
Subject Number	SBFOR1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Yoshiki Morimoto		
Main Theme of the Subject	One of the goals in synthetic organic chemistry is to arbitrarily synthesize complex organic compounds from relatively simple ones. It is fundamental and important in all the fields of science relevant to organic compounds. The aim of this course is to pr		
Goal of the Subject	The goals of this course are to understand the philosophy of total synthesis of natural products.		
Contents of the Subject /Subject Plan	The lecture will be conducted according to the following contents. (1) Virantmycin, FK506, and α-Sultone (2) Total Synthesis of Stemona Alkaloid Stenine (3) Oxasqualenoids and Rhenium(VII) Chemistry (4) Structure Elucidation and 6-endo THP (5) Epoxide-Opening Cascades (6) Total Synthesis of Lepadiformines (7) Total Synthesis of Isodehydrothyrsiferol		
Preparation and Review	Students are required to learn papers related to the lecture. Students are also required to submit a report (the task of summarizing recent research related to the lecture).		
Evaluation Method	Grading will be based on assessment of exercises (30%) and submitted reports (70%).		
Comments to Students	Students are expected to work on ambitious learning.		
Teaching Materials	If necessary, the teacher will distribute teaching materials.		
Remarks1			

Subject Code	SM21780011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Functional Advanced Physical Chemistry II		
Subject Number	SBFPH1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Daisuke Shiomi		
Main Theme of the Subject	To understand the interaction of electromagnetic waves and matters on the basis of quantum mechanics, quantum chemistry, and statistical mechanics. Rich varieties of spectroscopy and diffractometry are based on the interaction. The electromagnetic wave-ma		
Goal of the Subject	The methodology of several spectroscopic and diffractometric studies should be understood with application to electric and magnetic properties of crystalline materials. Exotic magnetic materials and metamaterials are studied as examples of material-orient		
Contents of the Subject /Subject Plan	1. Overviewing the methodology of several spectroscopic and diffractometric studies 2. Quantum mechanics and electromagnetism underlying spectroscopy and diffractometry 3. Maxwell's equations 4. Magnetic resonance spectroscopy 5. Generalized constitutional equations 6. Methodologies for magnetic properties of structurally engineered materials 7. Magneto-optical effects in magnets 8. Recent topics in metamaterials		
Preparation and Review	Preparation and review are recommended using research articles of the topics as specified in the lecture.		
Evaluation Method	Exercises (30%) and reports (70%)		
Comments to Students	Review of physical chemistry in the undergraduate course (statistical thermodynamics and quantum chemistry) is recommended.		
Teaching Materials	Handout materials including recent research articles		
Remarks1			

Subject Code	SM21800011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Functional Advanced Molecular Science		
Subject Number	SBFMS1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Ikuko Miyahara		
Main Theme of the Subject	X-ray crystallography is a powerful tool in the elucidation of the three-dimensional structures of small molecules and macromolecules. In this class, general crystallography and several new topics will be lectured.		
Goal of the Subject	To learn the structure determination of small and large molecules using single crystal X-ray crystallography.		
Contents of the Subject /Subject Plan	1 Diffraction of X-rays 2 Crystals, Symmetry, and Space group 3 Phase problem 4 Crystallization and Data collection 5 Refinement of Crystal Structures 6 Derived Results 7 Validation of Crystal structures 8 Current topics in crystallography		
Preparation and Review	After the classes, students study again the lecture note and distributed documents for understanding of the subject.		
Evaluation Method	Reports		
Comments to Students	None		
Teaching Materials	Articles will be distributed when appropriate.		
Remarks1			

Subject Code	SM21810011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Selected Topics in Creative Organic Chemistry 1		
Subject Number	SBCSO1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Takahiro Nishimura		
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 r		
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	SM21830011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Selected Topics in Creative InorganicChemistry 1		
Subject Number	SBCSI1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Toshiyuki Moriuchi		
Main Theme of the Subject	This class focuses on inorganic functional materials which have been rapidly developing recent years. Based on the basic knowledge of inorganic chemistry learned in the undergraduate course, advanced research and applications of inorganic chemistry will b		
Goal of the Subject	This course aims to provide students with a deeper knowledge of inorganic chemistry by selecting lecture topics from advanced coordination chemistry and organometallic chemistry. Intensive lectures will be given on the basic concepts of coordination chemi		
Contents of the Subject /Subject Plan	Course contents will be introduced at the beginning of the class		
Preparation and Review	Lecture materials will be delivered at the beginning of the class. Students are encouraged to review the materials after the class.		
Evaluation Method	Grading will be announced at the beginning of the class.		
Comments to Students	I hope you will actively participate in the lectures and broaden your view of inorganic chemistry.		
Teaching Materials	Lecture materials will be delivered at the beginning of the class.		
Remarks1			

Subject Code	SM21850011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Selected Topics in Creative Physical Chemistry 1		
Subject Number	SBCSP1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Kazuo Toyota		
Main Theme of the Subject	Advanced molecular science and chemical physics/physical chemistry based on the quantum theory provide the underlying knowledge for the understanding of modern materials science and chemistry. This course covers various topics interested in advanced physi		
Goal of the Subject	The goals of this course will be given at the beginning of the class.		
Contents of the Subject /Subject Plan	Course contents will be announced in advance.		
Preparation and Review	Informaton on self-learning will be announced in advance.		
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 given in the class.		
Remarks1			

Subject Code	SM21870011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Selected Topics in Functional Organic Chemistry 1		
Subject Number	SBFSO1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Tetsuro Shinada		
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 synthesi		
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	SM21890011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Selected Topics in Functional InorganicChemistry 1		
Subject Number	SBFSI1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Satoshi Shinoda		
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 b		
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	SM21910011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Selected Topics in Functional Physical Chemistry 1		
Subject Number	SBFSP1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Chie Hosokawa		
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		
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		
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 t		
Teaching Materials	To be announced separately.		
Remarks1			

Subject Code	SM21950011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Selected Topics in Integrated Molecular Chemistry 1		
Subject Number			
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Yasuyuki Tsuboi		
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	SM21980011	Offering Academic Year/Semester	2021 First Semester
Subject Name(English)	Functional Advanced BiophysicalChemistry II		
Subject Number	SBFBI1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Ritsuko Fujii		
Main Theme of the Subject	Photosynthesis is the only system that conducts chemical reactions using sunlight, which is the only external force coming to the earth. Photosynthetic pigments, which are organic compounds having relatively simple structures, are immobilized in proteins		
Goal of the Subject	(1) Understand the outline of the primary reactions of photosynthesis. (2) Understand examples of proposed mechanisms of the excitation energy transfer by using a combination of actual measurement and theory with respect to the structure, electronic state		
Contents of the Subject /Subject Plan	1) Sunlight and Photosynthesis 2) Structure of photosynthetic pigments in the pigment-protein complex 3) Structure and Electronic Excited States of Carotenoids 4) Structure and Electronic Excited States of Chlorophyll 5) Photoelectric photo conversion reaction in photosynthetic reaction center 6) Excitation energy transfer in the unoxygenic photosynthetic light-harvesting complex 7) Excitation energy transfer between the pigment-protein complexes 8) Regulation of Excitation energies in the oxygenic photosynthetic light-harvesting complex		
Preparation and Review	The outline will be explained in the first lesson. The basics of photochemistry should be understood beforehand. Study some of the original manuscripts mentioned in the classes are recommended as an ex-post learning.		
Evaluation Method	Evaluate by report.		
Comments to Students	Lecture will be mainly based on the researches done by the instructor in charge of this class.I also welcome students from different fields.		
Teaching Materials	Documents of lesson are distributed every time. Reference books will be introduced in the first lesson or handouts.		
Remarks1			

Subject Code	SM23110011	Offering Academic Year/Semester	2021 First Semester 2021 Second Semester
Subject Name(English)	International Seminar		
Subject Number	SBISE1501		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Toshiyuki Moriuchi		
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	SM23140011	Offering Academic Year/Semester	2021 Second Semester
Subject Name(English)	Functional Advanced Inorganic Chemistry II		
Subject Number	SBFIN1502		
Credit(s)	1 Credit	Teaching Method	Lecture
Lecturer(s)	Yasuyuki Tsuboi		
Main Theme of the Subject	Nano-sized particles of noble metals and semiconductors have various electronic, optical, and chemical functions and have been expected as advanced materials in the next generation. In this lecture, fundamental science and future technological perspective will be explained.		
Goal of the Subject	To be announced separately.		
Contents of the Subject /Subject Plan	1) What are mesoscopic materials? 2)What is nanotechnology? 3)Variety of mesoscopic materials and nanotechnology. 4)Size-dependent-electronic properties I 5)Size-dependent-electronic properties II 6)Synthesis of mesoscopic materials 7)Organic-Inorganic hybrid materials. 8)Plasmonics 9)Metamaterials 10)Future Perspective		
Preparation and Review	Preparation and review of each lecture are highly recommended.		
Evaluation Method	Report and test		
Comments to Students	These are very important to chemists in near future.		
Teaching Materials	Teaching materials will be delivered in each lecture.		
Remarks1			

Subject Code	SM24130013	Offering Academic Year/Semester	2021 First Semester 2021 Second Semester
Subject Name(English)	Exercises in Creative Molecular Science		
Subject Number	SBCMS1503		
Credit(s)	4 Credits	Teaching Method	Seminar
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 indi		
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		
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	2021 First Semester 2021 Second Semester
Subject Name(English)	Exercises in Creative Molecular Science		
Subject Number	SBCMS1601		
Credit(s)	4 Credits	Teaching Method	Seminar
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 indi		
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		
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	2021 First Semester 2021 Second Semester
Subject Name(English)	Exercises in Functional Molecular Science		
Subject Number	SBFMS1503		
Credit(s)	4 Credits	Teaching Method	Seminar
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 in		
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		
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	2021 First Semester 2021 Second Semester
Subject Name(English)	Exercises in Functional MolecularScience		
Subject Number	SBFMS1601		
Credit(s)	4 Credits	Teaching Method	Seminar
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 in		
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		
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	2021 First Semester 2021 Second Semester
Subject Name(English)	Advanced Research Course for Master's Thesis of Chemistry I		
Subject Number	SBARC1501		
Credit(s)	6 Credits	Teaching Method	Seminar／Laboratory
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 to Obtain 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 dissemina		
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	2021 First Semester 2021 Second Semester
Subject Name(English)	Advanced Research Course for Master's Thesis of Chemistry II		
Subject Number	SBARC1601		
Credit(s)	6 Credits	Teaching Method	Seminar／Laboratory
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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 to Obtain 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 dissemina		
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	SM40010033	Offering Academic Year/Semester	2021 First Semester 2021 Second Semester
Subject Name(English)	International Advanced Research Course for Master's Thesis of Science 1		
Subject Number			
Credit(s)	1 Credit	Teaching Method	Seminar
Lecturer(s)	Toshiyuki Moriuchi, Yoshio Teki, Tomoyuki Yatsuhashi, Eiko Mieda, Ken-ichi Yuyama, Yasuyuki Tsuboi, Yoshinosuke Usuki, Daisuke Shiomi, Yutaka Amao, Hiroshi Nakajima, Harukazu Yoshino, Satoshi Shinoda, Kazuo Toyota, Tetsuya Satoh, Masumi Itazaki, Ritsuko Fujii, Takanori Nishioka, Kenji Sakota, Hiroyuki Miyake, Ikuko Miyahara, Chie Hosokawa, Yoshimitsu Tachi, Masatoshi Kozaki, Tetsuro Shinada, Takahiro Nishimura, Yoshiki Morimoto, Atsushi Nakayama, Kazuhiko Sakaguchi, Keisuke Nishikawa, Kazunobu Sato		
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			