

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY2001	Physical Chemistry I	Undergraduate (low graders)	Theory	3	6	3	Major	Introduction to Chemical Thermodynamics: Fundamental concepts and machinery of the first law, the second law, the third law, the spontaneity and equilibrium, the phase rule and transformation of mixture, chemical potential in ionic and electrochemical system, etc., are lectured.
Chemistry	CHY2002	Organic Chemistry I	Undergraduate (low graders)	Theory	3	6	3	Major	A systematic introduction to the carbon compounds. Aliphatic and aromatic hydrocarbons, alcohols, ethers, halides, carbonyls, reaction mechanisms and stereochemistry.
Chemistry	CHY2003	Inorganic Chemistry I	Undergraduate (low graders)	Theory	3	6	3	Major	Systematic introduction to theories of electronic structure, chemical bonding and symmetry properties is lectured. Physical methods used for the determination of structure and the understanding chemical bonding are also discussed.
Chemistry	CHY2004	Analytical Chemistry I	Undergraduate (low graders)	Theory	3	6	3	Major	In this course, the theories of activity, solubility, and equilibrium and their applications to the analytical methods such as gravimetry, volumetry, acid/base titration, and complexometry will be covered. Data treatment will also be discussed.
Chemistry	CHY2005	Physical Chemistry II	Undergraduate (low graders)	Theory	3	6	3	Major	Introduction to Quantum Chemistry: Basic principles of wave mechanics, quantum mechanical operator, Schrodinger equation, harmonic oscillator, rigid rotor, hydrogen atom, atomic structure, molecular orbital, etc., are lectured.
Chemistry	CHY2006	Organic Chemistry II	Undergraduate (low graders)	Theory	3	6	3	Major	A sequel to organic chemistry I, focusing on the carbon compounds, Aliphatic and aromatic hydrocarbons, alcohols, ethers, halides, carbonyls, reaction mechanism and stereochemistry.
Chemistry	CHY2007	Inorganic Chemistry II	Undergraduate (low graders)	Theory	3	6	3	Major	This lecture deals with various theories of transition metal chemistry, including crystal field theory, magnetism, and photochemistry of metal complexes. Inorganic polymers and a variety of mechanisms for various inorganic reactions are also covered.
Chemistry	CHY2008	Analytical Chemistry II	Undergraduate (low graders)	Theory	3	6	3	Major	Principles of Electrochemistry, Potentiometry, Redox Titration, Electrogravimetry, Coulometry, and Voltammetry will be covered.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY2009	Physical Chemistry III	Undergraduate (low graders)	Theory	3	6	3	Major	Introduction to Symmetry: Symmetry of molecules, vibrational spectroscopy, rotational spectroscopy, electronic spectroscopy, magnetic resonance spectroscopy, basic principles of statistical thermodynamics, etc. are lectured.
Chemistry	CHY2010	Organic Chemistry III	Undergraduate (low graders)	Theory	3	6	3	Major	The study of the principles of widely used IR, NMR, UV and Mass spectrum for identification of organic compounds. Introduction to methods suitable for the deduction of structures by spectroscopy and how to operate instruments.
Chemistry	CHY2011	Physical Chemistry Laboratory I	Undergraduate (low graders)	Experiment	1	2	2	Major	Partial molar volume of liquid mixtures, determination of liquid vapor pressure, determination of freezing point, phase diagram of three component system, heat of solution, heat of neutralization, etc. are experimented.
Chemistry	CHY2012	Organic Chemistry Laboratory I	Undergraduate (low graders)	Experiment	1	2	2	Major	About 15 organic compounds will be synthesized. Experiments will be designed to introduce the techniques and manipulations of instruments.
Chemistry	CHY2013	Inorganic Chemistry Laboratory I	Undergraduate (low graders)	Experiment	1	2	2	Major	Synthesis of inorganic compounds and studies on their reactivity and identification by using chemical instruments are going to be explored.
Chemistry	CHY2015	Physical Chemistry Laboratory II	Undergraduate (low graders)	Experiment	1	2	2	Major	Data handling using computer, rate constants measured by laser refractometry, UV/Visible spectrometry, IR spectra of gas, rate of chemisorption, temperature desorption spectra are experimented.
Chemistry	CHY2016	Organic Chemistry Laboratory II	Undergraduate (low graders)	Experiment	1	2	2	Major	Synthesis of organic compounds and learning basic laboratory techniques will be the contents.
Chemistry	CHY2017	Inorganic Chemistry Laboratory II	Undergraduate (low graders)	Experiment	1	2	2	Major	As a continuum of Inorganic Chemistry Laboratory I, synthesis of inorganic compounds contained in the representative element of each group in the periodic table, study on their reactivity and identification by using chemical instruments are going to be carried out.
Chemistry	CHY3001	Special Lecture in Physical Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	In this course, fundamental theory and experimental methods of reaction kinetics and molecular reaction dynamics will be lectured as well as surface physical chemistry. First, fundamental concepts and developments of bimolecular collision theory, reaction dynamics, transition state theory, unimolecular reaction theory are introduced. Then, relation of empirical parameters in the reaction rate such as activation energy, pre-exponential factor is established. Further applicable reactions include simple gas phase reactions, solution phase reactions, surface reactions, catalytic reactions, photochemical reactions, polymerization reactions, etc.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY3002	Vacuum and Surface Science	Undergraduate (high graders)	Theory	3	6	3	Major	Importance of vacuum and its application, principles of vacuum, components and materials of vacuum apparatus, kinds and principles of vacuum pumps, techniques of surface analysis, deposition of thin film, etc. are lectured.
Chemistry	CHY3003	Computational Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	Students learn and practice, with a personal computer and software, manipulation of experimental data (transformation, fitting, plotting), molecular structure calculation with molecular mechanics, molecular drawing, solving eigenvalue problem, solving differential equation numerically, Monte Carlo simulation, etc.
Chemistry	CHY3005	Spectroscopy	Undergraduate (high graders)	Theory	3	6	3	Major	In this course, the symmetry of molecules, the selection rules of transition, the classification and the methods of spectroscopy, the basic principles of rotational spectroscopy, vibrational spectroscopy, electronic spectroscopy, nuclear and electron spin resonance spectroscopy will be lectured.
Chemistry	CHY3006	Special Topic in Organic Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	Modern chemistry is a principal elements that plays a key role in science and technology including materials, bio functional molecules, and environmental issues. The principle of chemical science and technology will be given a course on the basis of characteristic chemical bonds and chemical transformations which are fundamental aspects of materials. Chemical properties of materials in chapters 24-31 of Organic Chemistry by McMurry such as amines, carbohydrates, amino acids and peptides, lipids, DNA and functional polymers revealed by chemical compositions will be introduced.
Chemistry	CHY3007	Organic Reaction Mechanism	Undergraduate (high graders)	Theory	3	6	3	Major	Introduction to structural and stereo chemical problems by using molecular orbital and valence bond theory. Mechanistic aspects of organic reactions based on kinetics and thermodynamics with emphasis on nucleophilic substitution, addition, elimination, cyclization, and radical reactions.
Chemistry	CHY3008	Organic Synthesis	Undergraduate (high graders)	Theory	3	6	3	Major	Organic reactions with emphasis on principles of organic synthesis, (1) C-C bond formation, alkylation, acylation, carbonyl addition, and conjugate addition by nucleophiles, (2) introduction and interconversion of functional groups, oxidation, reduction, (3) synthetic strategy for the synthesis of biologically active natural products, bond disconnection, and retrosynthetic analysis.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY3009	Bioorganic Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	The application of the principles and theory of Organic Chemistry to the understanding of biological processes. Introduction to biosynthetic pathways of natural products, modern, molecular recognition, Supramolecular chemistry, asymmetric synthesis through enzymatic or nonenzymatic reaction pathways.
Chemistry	CHY3010	Biochemistry I	Undergraduate (high graders)	Theory	3	6	3	Major	Fundamentals of modern biochemistry, with special aspects of chemistry of carbohydrates, proteins, lipide and nucleic acids.
Chemistry	CHY3011	Biochemistry II	Undergraduate (high graders)	Theory	3	6	3	Major	As the continuation of the Biochemistry I, it focuses mainly on biogenesis, enzyme, metabolic and energy transfer, transcription of genetic information and cells.
Chemistry	CHY3012	Organic Spectroscopy	Undergraduate (high graders)	Theory	3	6	3	Major	Identification for organic compounds will be focused on the spectroscopic methods. For example, the fundamental theory for mass spectroscopy will be introduced for the determination of mass and structure of organic compounds. In addition, the basic conceptions of infrared spectroscopy and nuclear magnetic resonance will be given a course for understanding organic chemical structure with properties of spectroscopy.
Chemistry	CHY3013	Basic Organometallic Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	After studying the general properties of organometallic complexes, students are going to learn their reactivity and mechanisms for various reactions. In addition, the lecture is going to show how the organometallic chemistry is applied for organic synthesis and catalysis.
Chemistry	CHY3014	Molecular Symmetry	Undergraduate (high graders)	Theory	3	6	3	Major	Students are going to learn the way to determine point groups of molecules with various symmetry elements. The molecular symmetry is going to be applied for the studies of molecular orbital theory, ligand field theory, and spectroscopy of the molecules.
Chemistry	CHY3015	Materials Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	The Chemical principles of Inorganic Solid materials that exhibit a variety of structural, electronic, electrical, magnetic and optical properties will be lectured. The major topics will be the crystal structure, chemical bonding, band theory, and magnetic and electronic properties, and analytical methods of solid materials.
Chemistry	CHY3020	Undergraduate Thesis Research I	Undergraduate (high graders)	Independent Research	2	0	0	Major	Research for the preparation of B.S. thesis

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY3021	Undergraduate Thesis Research II	Undergraduate (high graders)	Independent Research	2	0	0	Major	Research for the preparation of B.S thesis
Chemistry	CHY3022	Instrumental Analysis 1	Undergraduate (high graders)	Theory	3	6	3	Major	Principles of Electronics, Optics will be introduced and analytical methods based on spectroscopy such as UV/VIS , Atomic Absorption, Fluorescence, IR, Raman, NMR and Mass Spectrometry will be covered.
Chemistry	CHY3025	Polymer Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	Students will be introduced to the concept of polymers in chemists' point of view. The background of polymer chemistry, several polymerization methods, their mechanisms, and kinetics will be covered. Emphasis will be on the molecular weight distribution of polymers, spectroscopic properties, structural properties, and molecular characteristics. In addition, several applications of various polymers to cutting-edge technologies and everyday lives will be briefly introduced.
Chemistry	CHY3026	Studies on biomolecules	Undergraduate (high graders)	Theory	3	6	3	Major	This course designed to provide students advanced knowledge of biomolecules and biological reactions including properties, structures and biological principles. In addition, this course deals with key papers covering past and current research accomplishments by subjects.
Chemistry	CHY3027	Biological Chemistry Laboratory	Undergraduate (high graders)	Experiment	1	2	2	Major	The goal of this course is to develop student's understanding of the fundamental principles of laboratory skills and train them how to use the equipment used in biological chemistry laboratories. Practical skills taught here include micro pipetting, basic solution preparation, protein expression and purification, enzyme activity assay, etc.
Chemistry	CHY3028	Analytical Chemistry Laboratory	Undergraduate (high graders)	Experiment	1	2	2	Major	One can learn practical procedures of analysis through the experiments of Gravimetry, Acid/Base Titration, Precipitation, Complexometry, Redox Titration, Spectroscopic Analysis(UV/VIS,IR,NMR).
Chemistry	CHY3029	Organic Electronic Materials and Its Applications	Undergraduate (high graders)	Theory	3	6	3	Major	We like to introduce newly functionalized organic electronic materials to students who are interested in organic synthesis, design and device applications. We also like to introduce a basic principle for organic devices, i.e. organic lighting emitting diode (OLED), organic thin film transistor, organic solar cell and molecular electronics. We may have several groups to present their investigation (homework and project).

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY3030	Bio-materials Applied Chemistry	Undergraduate (high graders)	Theory	3	6	3	Major	In this course, the theories and applications of technologies used in bio industry such as bio functional activity study, manufacturing process development, analytical process study and specifications of quality management to industrialize bio-materials will be lectured. Also this course will afford a chance to improve and expand the basic knowledge and understanding on fundamental technology used in pharma- and cosmetic-industry.
Chemistry	CHY4001	Advanced Physical Chemistry I	Graduate (Bachelor/Master)	Theory	3	6	3	Major	This course is intended for first-year graduate course in physical chemistry. The main contents of this course are concepts of operators, Schrödinger equation, quantum mechanical treatment of translational, vibrational and rotational motions of molecules which enable to understand of microscopic behaviors of molecular system.
Chemistry	CHY4002	Advanced Organic Chemistry I	Graduate (Bachelor/Master)	Theory	3	6	3	Major	The goal of this lecture is to provide the students with basic concepts in introductory organic chemistry and more advanced information and details in organic chemistry. The topics are the following: bonding theory, stereochemistry and various organic reactions.
Chemistry	CHY4003	Advanced Inorganic Chemistry	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Symmetry of compounds and its applications will be discussed in this lecture. This lecture consists of (1) definition and theorems of group theory, (2) molecular symmetry and the symmetry groups, (3) representations of groups, (4) group theory and quantum mechanics, (5) symmetry-adapted linear combinations, (6) molecular orbital theory and its applications in organic chemistry, (7) molecular orbital theory and inorganic and organometallic compounds, (8) ligand field theory, and (9) molecular vibrations. The ultimate goal of this lecture is to provide the graduate students capabilities to apply the group theory in their own research.
Chemistry	CHY4004	Advanced Analytical Chemistry I	Graduate (Bachelor/Master)	Theory	3	6	3	Major	In the class of Instrumental Analysis in undergraduate course deals generals of chemical instruments in many aspects. These days, many of universities update their undergraduate curricular in different ways. So quite many students did not have chance to take Instrumental Analysis class during their undergraduate course. In this aspect, we offer this class as one of our graduate core courses to provide basic instrumental analysis as well as application of instruments for chemical analysis.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY4005	Field Studies in Chemistry I	Graduate (Bachelor/Master)	Internship	1	2	0	Major	The principal aim of this field studies is to learn how the basic chemical principles are applied to the research and manufacturing systems in chemistry-related industry. Students will meet the chances to understand the application of a chemical principle may be vary depending on the given industrial environments. In addition, by this experience, students would have chances to understand the chemical principles at advanced level. (for 2 weeks)
Chemistry	CHY4006	Field Studies in Chemistry II	Graduate (Bachelor/Master)	Internship	2	4	0	Major	The principal aim of this field studies is to learn how the basic chemical principles are applied to the research and manufacturing systems in chemistry-related industry. Students will meet the chances to understand the application of a chemical principle may be vary depending on the given industrial environments. In addition, by this experience, students would have chances to understand the chemical principles at advanced level. (for 4 weeks)
Chemistry	CHY4007	Field Studies in Chemistry III	Graduate (Bachelor/Master)	Internship	3	6	0	Major	The principal aim of this field studies is to learn how the basic chemical principles are applied to the research and manufacturing systems in chemistry-related industry. Students will meet the chances to understand the application of a chemical principle may be vary depending on the given industrial environments. In addition, by this experience, students would have chances to understand the chemical principles at advanced level. (for 6 weeks)
Chemistry	CHY4008	Field Studies in Chemistry IV	Graduate (Bachelor/Master)	Internship	4	8	0	Major	The principal aim of this field studies is to learn how the basic chemical principles are applied to the research and manufacturing systems in chemistry-related industry. Students will meet the chances to understand the application of a chemical principle may be vary depending on the given industrial environments. In addition, by this experience, students would have chances to understand the chemical principles at advanced level. (for 8 weeks)
Chemistry	CHY5001	Advanced Physical Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	For last two centuries This course in the consecutive course of the Advanced Physical Chemistry 1. And is intended for graduate courses in physical chemistry. The main purpose of this course is that to train students with rigorous treatment of molecular orbital theory which are of practical interest to organic and inorganic as well as physical chemistry.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5003	Chemical Kinetics	Graduate (Master/PhD)	Theory	3	6	3	Major	In this course, various chemical reaction rate theories are lectured from the viewpoint of their foundations and interpretations of experimental results. First, fundamental concepts and developments of bimolecular collision theory, potential energy surface, reaction dynamics, transition state theory, unimolecular theory are introduced. Then, relation of empirical parameters in the reaction rate such as activation energy, preexponential factor is established. Rate law is defined and analyzed using differentiation method, integration method, half-lifetime method, etc. to be applicable to experiments. Further applications of the rate law to consecutive reactions, complex reactions, chain reactions, etc. are studied with steady state approximation or preequilibrium condition. The applicable reactions include simple gas phase reactions, solution phase reactions, biomolecular reactions, surface reactions, catalytic reactions, photochemical reactions, polymerization reactions, atmospheric reaction
Chemistry	CHY5004	Chemical Reaction Dynamics	Graduate (Master/PhD)	Theory	3	6	3	Major	This course emphasizes experimental and theoretical aspects of chemical reaction dynamics. Molecular beam system and laser chemistry techniques will be discussed. Classical trajectory, semi classical collision theory will be applied simple elastic, inelastic scattering in elementary chemical reactions.
Chemistry	CHY5007	Statistical Thermodynamics I	Graduate (Master/PhD)	Theory	3	6	3	Major	In this course, the applications of the statistical mechanics to equilibrium chemical systems that deviate from ideal behavior are discussed. Topic will include distribution functions in monoatomic liquids, perturbation theory of liquid, solution of strong electrolytes, kinetic theory of gases and molecular collision, continuum mechanics, phase space and Liouville equation, transport process in dilute gases.
Chemistry	CHY5010	Advanced Quantum Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is intended for graduate course for M.S. and Ph.D. program in physical chemistry major. The main contents of this course are concepts of creation and annihilation operators, angular momentum couplings, group theory, approximation methods. Many electron wavefunction will be discussed and the basis-set solution for time-dependent Schrödinger equation also discussed.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5011	Molecular Spectroscopy	Graduate (Master/PhD)	Theory	3	6	3	Major	In this course, theoretical background and experimental methods of various molecular spectroscopy will be lectured. After reviewing some fundamentals of quantum theory, electromagnetic radiation and its interaction with atoms and molecules, general features of experimental methods, molecular symmetry, rotational spectroscopy, vibrational spectroscopy, electronic spectroscopy, photoelectron and related spectroscopy will be studied.
Chemistry	CHY5014	Computer Aided Molecular Design	Graduate (Master/PhD)	Theory	3	6	3	Major	This course emphasizes computer aid molecular design. For the purpose, we will discuss various quantum mechanical treatment of molecular electronic calculation methods, such as empirical, semi-empirical and Ab initio methods. The applications of those methods to simple organic and inorganic compounds are tested using computing systems. Further application biological molecules will be discussed with molecular mechanics.
Chemistry	CHY5017	Surface and Interface Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Surface and Interface Chemistry is one of the most important fields of modern science and technology due to its wide application and usefulness for the material science. This lecture provides graduate students with a general concept and popular examples of materials chemistry and puts an emphasis on the relationship between surface and interface in the film layer of solid-solid or solid-gas phases.
Chemistry	CHY5018	Semiconductor Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Semiconductors such as SiC, BN, AlN, GaN, and diamond are currently attracting increasing attention due to their interesting properties and to their wide industrial applications compared with the conventional semiconductors like Si and GaAs. This lecture is intended for graduate students who confront with the field of semiconductor chemistry and related studies for the first time. Emphasis of this class is laid on epitaxial growth of their thin films using PVD and CVD techniques and material properties such as structural, electrical, optical, defects, etc. that can be measured by various surface characterization instruments. Basic concepts of device processing and applications are also discussed.
Chemistry	CHY5019	Surface Physical Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	In this course, fundamental theory and experimental methods of surface physical chemistry will be lectured. After reviewing some basic background of thermodynamics and kinetics related to the adsorption-desorption, some of the experimental examples obtained from surface research will be studied.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5024	Thin Film Materials Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Applications of thin films in optics and electronics have made extraordinary rapid progress in recent years. Consequently, the development of deposition methods and techniques for thin films with controlled, reproducible, and well-defined properties play an important role in technological applications. In the first part of this lecture, the most fundamental concepts and ideas of thin film materials chemistry to understand of its basis. Its second part deals with a wide applications of thin film materials chemistry that used in current industrial process.
Chemistry	CHY5027	Advanced Organic Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	As a consecutive course of Advanced Organic Chemistry I, this lecture is intended for graduate students who want to study organic chemistry in depth. The topic to be treated are the reactive intermediates in organic reactions such as carbocation, carbanions, carbenes and radicals.
Chemistry	CHY5028	Organic Reactions I	Graduate (Master/PhD)	Theory	3	6	3	Major	The purpose of this lecture is to provide a deeper understanding of organic reactions to graduate students. This lecture deals with nucleophilic aliphatic and aromatic substitution reaction, electrophilic aliphatic addition reaction, electrophilic aromatic substitution reaction and elimination reaction.
Chemistry	CHY5029	Organic Reactions II	Graduate (Master/PhD)	Theory	3	6	3	Major	As a consecutive course of Organic Reactions I, this lecture deals pericyclic reactions such as Diels-Alder reaction, cope and claisen rearrangements, electro cyclic reaction and the various cycloaddition reactions.
Chemistry	CHY5030	Studies in Organic Reactions I	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the important recent advances in the field of organic reactions. The students will present and discuss the results that are taken from the major journals. Emphasis will be on the recent developed, synthetically useful organic reactions.
Chemistry	CHY5031	Studies in Organic Reactions II	Graduate (Master/PhD)	Theory	3	6	3	Major	As a consecutive course of Studies in Studies in Organic Reactions I, this lecture deals with the important recent advances in the field of organic reactions. The students will present and discuss the results that are taken from the major journals. Emphasis will be on the development of novel catalysts for the selective organic synthesis.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5032	Studies in Organic Synthesis I	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the important recent advances in the field of organic synthesis. The students will present and discuss the results that are taken from the major journals. Emphasis will be on the recent achievement in organic synthesis of complex molecules.
Chemistry	CHY5034	Methods in Organic Synthesis I	Graduate (Master/PhD)	Theory	3	6	3	Major	The goal of this lecture is to understand biological processes with the basic principles of enzyme action and DNA, and the application of the principles and tools of organic chemistry to the understanding of these biological processes.
Chemistry	CHY5041	Transition Metal-Catalyzed Organic Reactions	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the basic principles on transition metal-catalyzed organic reactions. Emphasis will be on the reactions which are useful in organic synthesis such as palladium, copper, cobalt, rhodium, zirconium and titanium catalyzed organic reactions.
Chemistry	CHY5042	Catalysis in Organic Reactions	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the basic principles of catalysis in organic reactions. Emphasis will be on catalysts which are used frequently for organic synthesis of complex compounds. Topics included are the various Lewis acid and organometallics as selective catalysts for organic synthesis.
Chemistry	CHY5044	Organic Stereo Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	The purpose of this lecture is to provide basic principles of stereochemistry of organic compounds to graduate students. Emphasis will be on stereo electronic effects of organic reactions.
Chemistry	CHY5047	Bioorganic Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	The goal of this lecture is to understand biological processes with the knowledge of organic chemistry. This lecture deals with the basic principles of enzyme action and DNA, and the application of the principles and tools of organic chemistry to the understanding of these biological processes.
Chemistry	CHY5048	Organic Reaction Mechanism	Graduate (Master/PhD)	Theory	3	6	3	Major	The goal of this lecture is to provide details on organic reaction mechanisms to graduate students. Emphasis will be on the introduction of the basic techniques used to elucidate mechanisms of organic reactions, and its exemplary applications to organic reactions

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5049	Asymmetric Organic Synthesis	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the basic principles of asymmetric catalysis and places particular emphasis on its synthetic significance. Topics included are asymmetric hydrogenation, asymmetric hydride transfer reaction, and asymmetric addition of organometallic compounds to carbonyl compounds and asymmetric epoxidation and dihydroxylation of olefins.
Chemistry	CHY5052	Solid Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	As a consecutive course of Solid State Chemistry I, this lecture is also concerned with the solids. This class puts an emphasis on transition-metal oxides. The topics to be treated are as following: introduction, models of electronic structure, insulating oxides, defects and semiconductors, metallic oxides, superconductivity.
Chemistry	CHY5055	Advanced Inorganic Chemistry I	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture deals with the most recently published results in the field of Inorganic Chemistry. This lecture has no text and deals with the papers and articles that have been published within the past three years. The students will present, discuss, and criticize the results that are taken from the major journals.
Chemistry	CHY5056	Advanced Inorganic Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	This class deals electron configurations, crystal field theory, group theory and spectroscopic results for the transition metal complexes.
Chemistry	CHY5057	Materials Chemistry I	Graduate (Master/PhD)	Theory	3	6	3	Major	Sensors are important in automatic control systems. Typical chemical sensors are introduced and their specific structure and control circuits are covered.
Chemistry	CHY5058	Materials Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	This class deals electronic and catalytic materials in the inorganic chemical analyses.
Chemistry	CHY5060	Crystallography II	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture gives the structural side of inorganic chemistry and consists of two parts. Part I deals with a number of general topics, including the properties of polyhedra, the nature and symmetry of repeating patterns, and the ways in which spheres, of the same or different sizes, can be packed together. Part II deals with the structural chemistry of elements based on the periodic table.
Chemistry	CHY5062	Advanced Analytical Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	Personal computers are used in lab for controlling instruments and data acquisition purposes. Interfacing work between PC and Instrument have been done in lab frequently. Digital theory, digital circuits, and PC interfacing will be introduced in this class. Average graduate student can easily complete this course.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5063	Advanced Electrochemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Theory concerning redox reaction of the solution species is covered. The classic theories of electrochemistry is discussed and concepts in new material reactions.
Chemistry	CHY5066	Advanced Environmental Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Advanced Environmental Chemistry deals with atmospheric composition and behavior, energy and climate first, and then principles of photochemistry that has been one of major topics in Environmental Chemistry recently. With these backgrounds, atmospheric photochemistry air pollution, water pollution, soil pollution and the problems in the nuclear environment will be discussed.
Chemistry	CHY5072	Spectroelectrochemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Voltage, current, charge are the classic parameters in electrochemistry. The classic methods cannot produce information about the redox reaction at near the electrode surface at molecular level. In situ methods of UV/VIS, IR, Raman, X-ray spectroscopy are covered in this class.
Chemistry	CHY5074	Scientific Writing of Chemistry Paper in English	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture is intended to give graduate students a general guideline to writing a scientific paper in English. The lecture deals with the following: components of a paper, grammar, editorial style, word usage, and references.
Chemistry	CHY5077	Thesis Research I	Graduate (Master/PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of M.S. candidate students and lower level Ph.D. candidate students.
Chemistry	CHY5078	Thesis Research II	Graduate (Master/PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of M.S. candidate students and lower level Ph.D. candidate students.
Chemistry	CHY5081	Nucleic Acids Biochemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	This course aims to provide solid foundation of nucleic acid research, one of major areas of modern biological researches. The course deals with the basic concepts of structure and function of nucleic acids. It will also cover recent findings in new structures and functions, and new trends in diagnosis and drug discovery using nucleic acids.
Chemistry	CHY5082	Protein Biochemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Proteins are the most abundant macromolecules in living systems, and they play critical roles in most of various biological processes. To better understand life processes it is important to know how proteins function in biological systems. This course is designed to provide students with a solid foundation in protein biochemistry: protein molecular properties, protein biosynthesis, interactions with other molecules, the role of proteins in biochemical processes and proteomics.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5083	Current Topics in Biological Chemistry 1	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is designed to train students to learn recent progress of biological chemistry from scientific literatures. Both review articles and research articles from selected current research topics in the rapidly evolving areas of biological chemistry will be covered. Selected areas of the course of advanced study varies to suit the interest and needs of faculty and students. Each topic considers the most recent advances in the particular field by analyzing the recent literature, such as the structure and function of enzymes, metabolic regulation, nucleic acid, biochemistry, and analytical biochemistry.
Chemistry	CHY5084	Current Topics in Biological Chemistry 2	Graduate (Master/PhD)	Theory	3	6	3	Major	As a consecutive course of Current Topics in Biological Chemistry 1, this course continues to deal with review articles and research articles from the selected current research topics in the rapidly evolving areas of biological chemistry.
Chemistry	CHY5085	Nanocatalysis	Graduate (Master/PhD)	Theory	3	6	3	Major	In heterogeneously catalyzed reactions, solid nanostructures can be used as catalysts. Catalytic activity of nanostructures is often much different from those of the respective single crystal surfaces, which has been extensively studied in the past in surface chemistry. This lecture covers synthesis, characterization of electronic and geometric structures and catalytic activity of various nanostructures. In addition, principles of analysis tools of nanostructures will be discussed. Since catalytic activity is related to the surface structures, surface analysis techniques should be used, which will be discussed in this lecture.
Chemistry	CHY5087	Advanced Polymer Chemistry I	Graduate (Master/PhD)	Theory	3	6	3	Major	Student will learn synthetic chemistries of polymerization from traditional approaches to precisely controllable methods. Traditional approaches includes anionic polymerization, radical polymerization, cationic polymerization, and condensation polymerization. Other synthetic methods will be covered, including ring-opening polymerizations, atom transfer radical polymerization (ATRP), and metal-catalyzed polymerizations. Polymer properties will be related to the microstructure of polymers, such as chain conformation, molecular-weight distribution, sequence distribution, and head-to-head connectivity.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5088	Advanced Polymer Chemistry II	Graduate (Master/PhD)	Theory	3	6	3	Major	Students will be introduced to advanced polymers that are being utilized in the cutting-edge technology and state-of-the-art research. Block copolymers, polymer electrolytes, conjugated polymers, dendrimers will be covered in terms of their structures and properties, and how they are useful in leading technologies such as polymer solar cells, organic transistors, fuel cells, drug delivery, and imaging tools.
Chemistry	CHY5089	Advanced Biological Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Biochemistry is a study of understanding the structure, organization and function of living matters. This course provides students a deeper understanding of the functional properties of biological molecules and systems. The course will cover biosynthesis of cell components, essential metabolites, and assimilation of carbon and nitrogen and control systems. For undergraduate students, two-semester of biological chemistry are prerequisite.
Chemistry	CHY5090	Organic Electronic Materials Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Student will learn the basic physical and chemical properties of organic electronic materials in AMOLED, LCD and semiconductors. In addition, the structure-property relationship of organic electronic materials will be studied in the molecular level. To develop the efficient organic electronic materials, the basic organic reaction mechanism and the organic synthetic methods for the synthesis of new materials will be studied.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5091	Modern Physical Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Modern physical chemistry expands its field to materials chemistry, nano-chemistry, energy science, etc. This means the role of physical chemistry is growing. With the help of knowledge of physical chemistry new phenomena could be better understood and creative research outputs might be achieved. In this regards, it is very important to learn various techniques (state of the art equipment in surface analysis, laser chemistry, theoretical tools, etc.) to understand interesting chemical phenomena through recently published research articles. In this course, the students will learn such various techniques. This course covers various subjects, nano-chemistry, materials chemistry, catalytic reactions, proteins, DNA/RNA, enzyme, OLED, molecular magnets, photovoltaic cells, batteries, etc. In this course, the students also have a chance to give a presentation for any subject related to their own research interests. English is an official language in this class.
Chemistry	CHY5092	Convergence Physical Chemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Diverse analytical tools have been developed in modern experimental physical chemistry. Scanning tunneling microscopy is not only limited to the study of atomic structures of surfaces, but also can be used for orbital imaging, single molecule vibrational spectroscopy and selection rules in optical transitions. Femtosecond laser allows studies of electronic transition in real time scale. Such experimental techniques are used for studying physical and chemical behaviors of diverse materials such as single crystals, graphene and quantum dots. Also, fuel cells, solar cells, OLED, optical materials, etc., have been emerged as important research topics. For development of those related devices, use of theoretical and experimental physicochemical methodologies is essential. In this lecture, principles of modern experimental tools of physical chemistry and their applications will be discussed.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Chemistry	CHY5093	Computer Simulation	Graduate (Master/PhD)	Theory	3	6	3	Major	The collaborative research between theoretical and experimental studies has become more and more important in modern chemistry. For example, to develop better functional materials such as a catalyst yielding high selectivity, the fundamental functioning mechanism should be understood, which demand in-depth understanding based on quantum chemical calculations. In this course, we learn state of the art quantum chemistry in connection with experimentally observed interesting phenomena, and more importantly, the students have a chance to experience to perform quantum calculations using supercomputing systems in KISTI. In this course, the students also have a chance to give a presentation for any subject related to their own research interests. English is an official language in this class.
Chemistry	CHY5094	Plasmonics	Graduate (Master/PhD)	Theory	3	6	3	Major	Nano science is a modern research field on which many researchers have been intensively and extensively studied. Among them, Plasmonics has attracted a special attention. However, the contents cannot be covered in existing courses. Because it should include theoretical (including classical electromagnetics and quantum mechanical effects) development, material synthesis and control, and the understanding the physical phenomena of Plasmon behaviors (in particular surface Plasmon). Thus, this course requires a convergence approach from three main fields. Therefore, this course will be useful for the students to understand the plasmatic behavior and to utilize the Plasmonics properties by controlling nanomaterials.
Chemistry	CHY6001	Thesis Research III	Graduate (PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of Ph.D. candidate students
Chemistry	CHY6002	Thesis Research IV	Graduate (PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of Ph.D. candidate students
Chemistry	CHY6003	Thesis Research V	Graduate (PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of Ph.D. candidate students
Chemistry	CHY6004	Thesis Research VI	Graduate (PhD)	Independent Research	3	6	0	Major	Research for the preparation of thesis of Ph.D. candidate students