Description of Courses

▣ Undergraduate

CH211 물리화학 I (Physical Chemistry I) 3:0:3(3)

This course is fundamental concepts of quantum mechanics will be covered especially for the description of chemistry at the molecular level. The energetic structures associated with electronic and nuclear motions in atoms and molecules will be lectured for the understanding of molecular structures and chemical reactions.

CH213 물리화학 II (Physical Chemistry II) 3:0:3(3)

This course presents thermodynamic principles and their chemical applications to gases, liquids, and solids with an emphasis on equilibrium properties of chemical reactions, phase, and solution.

CH221 유기화학 I (Organic Chemistry I) 3:0:3(3)

This course is aimed at sophomores in chemistry-related fields and covers the basic concepts and general principles of organic chemistry to give students an ability to explore structure analysis, organic reactions, and applications for their own advanced study.

CH223 유기화학 II (Organic Chemistry II) 3:0:3(3)

This course presents sophomores in chemistry-related field the basic concepts and the general principles of organic chemistry and gives them the ability to explore structural analysis, organic reactions, and applications useful for advanced study. Topics covered include: alicyclic hydrocarbons, aromaticity and electrophilic aromatic substitution, arenes and their derivatives, spectroscopy and structure, alcohols, ethers and epoxides, neighboring group effects and catalysis by transition metal complexes, aldehydes and ketones, enantiotopic and diastereotopic ligands and faces, carboxylic acids, carboxylic acid derivatives, aldol and Claisen condensations, tests.
Prerequisite Course: CH221

CH252 화학전공실험 I (Chemistry Major Lab-I) 0:6:2(3)

This is designed for students majoring in Chemistry to practice the basic techniques of chemical experiments mainly in physical and analytical chemistry fields.

CH263 분석화학개론 (Introduction to Analytical Chemistry) 3:0:3(3)

This course is designed to give sophomore chemistry majors a brosd scope of analytical chemistry from simple chemical methods to instrumental methods. It includes data analysis, systematic treatment of chemical equilibria, acid-base titrations, electroanalytical methods, spectroscopic techniques, mass spectrometry, and chromatography.

CH315 물리화학 III (Physical Chemistry III) 3:0:3(3)

This course is gives junior chemistry majors a broad scope of physical chemistry covering fundamental concepts of transport, spectroscopy, kinetics, statistical thermodynamics, and solid state materials. Emphasis is on properties of ideal and non-ideal solutions, surface phenomena, structure of matter, transport properties, chemical kinetics, and electrochemistry Prerequisite Course : General Chemistry, Calculus, Analytical Chemistry, Physical Chemistry I

CH325 생유기화학 (Bioorganic Chemistry) 3:0:3(3)

The purpose of this course is for students to learn the fundamental chemistry of the molecules of life in one semester. After completion of this course, students ought to understand the molecular structure and the reactivity of organic molecules.

CH336 물리유기화학 (Physical Organic Chemistry) 3:0:3(3)

This course is designed to give juniors in chemistry an insight of bonding and conformational analysis, nucleophilic substitution at carbon, elimination and addition reactions, carbene chemistry and cycloaddition reaction.

Topics include : Structure and mechanism, aliphatic nucleophilic substitution, elimination reactions, addition reactions, aromatic electrophilic substitution, molecular rearrangement, aliphatic radical substitution, pericyclic reaction, kinetic studies, linear Gibbs energy relations, acid & bases, and reaction medium.

CH344 무기화학I (Inorganic Chemistry I) 3:0:3(3)

This course is designed to equip undergraduates in chemistry at KAIST with a modern insight of inorganic chemistry with a good balance among theoretical development, descriptive chemistry, and applications. The principal purpose is to develop the fundamental concepts of transition metal coordination compounds such as the molecular symmetry, group theory, structures, bonding, electronic spectra, acid-base chemistry and reaction mechanisms.

CH345 무기화학 II (Inorganic Chemistry II) 3:0:3(3)

This course is designed to provide juniors in chemistry with an understanding of periodic trends for the elements, simple compounds and more complex compounds. Course topics include : periodic trends for the elements, complex compounds, solid-state chemistry, solution chemistry.

Prerequisite by topics : Review of atomic theory, theories of chemical bonds, molecular symmetry in inorganic chemistry, theories of coordination chemistry.

Prerequisite course: CH241

CH352 화학전공실험 II (Chemistry Major Lab-II) 0:6:2(3)

This is designed for students majoring in Chemistry to practice the basic techniques of chemical experiments especially in the organic field. The class is consisted of organic reactions such as oxidation and C-C bond-forming reactions, which are essential parts of oragnic transformations.

CH353 화학전공실험 III (Chemistry Major Lab-III) 0:6:2(3)

This is designed for students majoring in Chemistry to practice the basic techniques of chemical experiments mainly in inorganic chemistry and biochemistry fields.

CH381 생화학 I (Biochemistry I) 3:0:3(3)

This course is designed to teach structure and function of protein, storage of metabolic energy, and introduce recombinant DNA technology for various biochemical studies. Topics discussed include : amino acids and proteins, molecules of heredity, protein conformation, enzymes, introduction to biological membranes, bioenergetics, carbohydrates, glycolysis, the citric acid cycle, oxidative phosphorylation, pentose phosphate pathway, gluconeogenesis, glycogen metabolism.

CH382 생화학 II (Biochemistry II) 3:0:3(3)

This course is designed to teach metabolic reactions of biomolecules and their regulation in

chemical, physiological, and genetical aspects.

CH416 분자분광학개론 (Introduction to Molecular Spectroscopy) 3:0:3(3)
This course is using the light-matter interaction, molecular structures can be experimentally determined. Theoretical background for the interpretation of the experiment will be lectured with some practical examples. Basic concepts and application of molecular spectroscopy will be given.

CH417 화학반응동력학 (Chemical Reaction Dynamics) 3:0:3(3)
This course is covers chemical kinetics with a discussion of various theories. Theories of rate constants and chemical dynamics are treated with special emphasis on applications to other fields, including industry.

CH418 계산화학 (Computational Chemistry) 2:3:3(3)
This course covers numerical methods for molecular mechanics, the principle of molecular dynamics and the Monte Carlo method.

CH419 고체화학개론 (Introduction to Solid-State Chemistry) 3:0:3(3)
This course will introduce physical chemical properties of solids and nanostructured materials including crystal structure, lattice vibration, electronic band structure, electrical conductivity, optical properties and magnetism.

CH437 유기분자 구조의 분석과 이해 (Structure Determination and Comprehension of Organic Molecules) 3:0:3(3)
This course treats modern spectroscopic techniques used for structure elucidation of organic compounds and spectral data analysis techniques. In depth discussion of the structural origin of secondary metabolites will be provided.

CH438 유기반응 및 합성 화학 (Organic Reactions and Synthesis) 3:0:3(3)
The purpose of this course is for students to understand the mechanism and the reactivity of various organic reactions in detail and to apply the basic knowledge to design synthetic strategies for the total synthesis of natural product, new drug candidates and new electronic materials.

CH439 유기금속 화학 개론 (Introduction to Organometallic Chemistry) 3:0:3(3)
Organometallics using either transition metals or main group metal species have been explosively expanded as demonstrated in the recent Nobel prize in chemistry for those chemistry (2001, 2005, and 2010). In this class, a range of aspects of the organometallics chemistry including theoretical background, basic concept, important organometallic reactions, and synthetic applications will be delivered to senior undergraduates and graduate students.

CH444 무기반응 및 분석 (Inorganic Reactions and Spectroscopy) 3:0:3(3)
This course is designed to give juniors and seniors in chemistry a fundamental theory about the physical methods starting from molecular symmetry and group theroy. The principal purpose is to establish a foundation of physical methods to characterize both diamagnetic and paramagnetic inorganic and organometallic compounds, which involves various spectroscopic techniques.

CH450 화학 원어논문 작성 및 발표 (Chemical Writing and Presentation) 3:0:3(3)
Anyone making a career in chemistry must be able to write acceptable scientific papers and presentations in English. This course aims to guide chemistry graduates and senior undergraduates with English as a second language to organize and write effective manuscripts and to deliver better

presentations in English. The course is fully interactive and is based on abundant practice.

CH451 고급화학실험 (Advanced Chemistry Lab.) 0:6:2(3)

This is designed for students majoring in Chemistry with the basic techniques of chemical experiments. This course provides advanced techniques in chemical experiments and research methods and offers students opportunities to identify one's favorite research field in chemical science.

CH452 나노화학개론 (Introduction to Nanochemistry) 3:0:3(3)

Nanoscience and nanotechnology are utilizing new physicochemical properties that appear when the size of material is reduced to nanometer. Students will learn the fundamental basics of nanoscience and its application as a chemist. They will study how to synthesize nanoparticle, nanowire, thin film and combined structures of such nanomaterials as well as their unique properties. Furthermore, diverse applications including plasmonics, nanosensor, catalysis, biomaterial, mechanics, material science will be introduced.

CH453 인공지능 화학 (AI Chemistry) 3:0:3(3)

AI has attracted great attention as a new powerful tool for chemical research. In this course, we will discuss the role of AI in modern chemistry and look at the latest trends in this field. It aims to learn practical knowledge that can be used in actual research field through theory and practice focused on deep learning.

CH464 전기화학분석 (Electroanalytical Chemistry) 3:0:3(3)

This course introduces fundamental electroanalytical concepts, electrochemical thermodynamics and kinetics, and is purposed to understand various electroanalytical experimental designs and the recent research works.

CH471 고분자화학개론 (Introduction to Polymer Chemistry) 3:0:3(3)

This course is designed to provide introductory knowledge on polymer chemistry to undergraduate students in the department of chemistry. Structure and properties of polymers as high molar-mass macromolecules will be discussed along with the synthetic methodologies and thermodynamic behavior.

CH481 생체분자분석개론 (Introduction to Biomolecule analysis) 3:0:3(3)

This course is to introduce various biophysical methods to analyze biomolecules such as proteins, nucleic acids. The course will include mass spectrometry, cryo-electron microscopy, x-ray crystallography, and so on.

CH484 화학생물학개론 (Introduction to Chemical Biology) 3:0:3(3)

This class focuses on understanding basic scientific principles underlying chemical biology that is an emerging interdisciplinary research field. Students will learn a variety of aspects of chemical biology ranging from fundamentals to applications. Main textbook would be "Chemical Biology" edited by Stuart L. Schreiber (Wiley-VCH). (Prerequisite course: CH381)

CH485 현대화학특강I (Special Topics in Modern Chemistry I) 3:0:3(3)

This course introduces new disciplines focusing on recent research results in chemistry-related fields

and systematically discusses latest research trends. In particular, it introduces interdisciplinary research directions centered on convergence and collaboration work among other academic fields.

CH490 졸업연구 (Undergraduate Research) 0:6:3

CH491 LRP (Laboratory Rotation Program) 0:3:1

CH492 학부 콜로퀴움 (Undergraduate Colloquium) 0:3:1

CH495 개별연구 (Individual Study) 0:6:1

▣ Graduate

CH502 양자화학 I (Quantum Chemistry) 3:0:3(3)

The purpose of this course is to give graduate students in Chemistry the ability to understand electronic structure and spectroscpoic properties of atoms and molecules by means of theoretical techniques, such as ab initio and semiempirical methods. Topics include : Hartree-Fock Approximation, configuration interaction, ab initio and semiempirical methods.
Prerequisite Course: CH315
Prerequisites by topic: Matrix algebra, Hypergeometric functions, Fundamentals of classical mechanics, and Group theory.

CH503 통계열역학 I (Statistical Thermodynamics I) 3:0:3(3)

This course covers the principles of statistical mechanics and many practical applications involving gas, solid, liquid, surface and dielectric properties. Also, emphasis is made on the dynamical aspects of topics such as transport phenomena and chemical reactions. Statistical mechanics of gas, solid, liquid, surface, dielectric properties, transport, phenomena is also covered.

CH504 고급물리화학 (Advanced Physical Chemistry) 3:0:3(3)

This course, diverse fields of physical chemistry, such as quantum chemistry, computational chemistry, spectroscopy, chemical kinetics, and surface & solid state chemistry, will be discussed to help graduate students whose research field is non-physical chemistry to grasp the core concepts of physical chemistry.

CH521 고급유기화학 (Advanced Organic Chemistry) 3:0:3(3)

This course surveys both classical and modern concepts using electronic interpretation of organic reactions. Topics include electrophilic reactions of Aromatic compounds, Nucleophillic reactions, Stereochemistry, Hammett linear free-energy relationships, Adddition-elimination molecular rearrangements and Woodward-Hoffmann-type relationships.

CH522 유기합성 I (Organic Synthesis I) 3:0:3(3)

The lecture covers carbon-carbon bond formation of organic syntheses including alkylation, aldol condensation, free radical reaction rearrangement and cycloaddition reaction.

CH523 유기합성 II (Organic Synthesis II) 3:0:3(3)

This course allows graduate students in Chemistry to survey new widely applied synthetic methods in organic synthesis and to understand the basic ideas and advances in the field.
Topic include : Formation of carbon-carbon single bonds, formation of carbon-carbon double bonds, the Diels-Alder and related reactions, Reactions at unactivated C-H bonds, Synthetic applications of organoboranes and organosilanes, Oxidation reactions, and Reduction reactions.

CH541 고급무기화학 (Advanced Inorganic Chemistry) 3:0:3(3)

This course is intended for first-year graduate students. The principal purpose is to introduce the fundamental theoretical concepts of geometrical and electronic structures of transition element compounds.
Descriptive Chemistry will not be developed to any great extent in this lecture. Prerequisite by topic: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry

CH542 유기금속화학 (Organometallic Chemistry) 3:0:3(3)

This course is designed for senior undergraduate and graduate students in teaching reaction mechanisms, and synthetic and catalytic aspects of transition metal organometallic compounds.
Prerequisite Courses : CH341 and CH342
rerequisite by Topics: General properties of organometallic complexes, survey of organometallic complexes and their reactions categorized by ligands, reaction mechanisms, characterization of organometallic complexes, catalytic processes, applications to organic synthesis, and bioorganometallic Chemistry.

CH581 고급생화학 (Advanced Biochemistry) 3:0:3(3)

This course covers advanced description of biosynthesis of macromolecules including such topics as replication gene expression, protein synthesis as well as a discussion of nature and functional aspects of protein and nucleic and structures.

CH582 단백질 화학 (Protein Chemistry) 3:0:3(3)

This class aims to understand proteins and their actions by studying basic chemistry, kinetics, and thermodynamics, and structure. Students will gain an understanding of protein structure and activity relationship and principle mechanisms governing protein stability and folding. Lastly, the course will focus on recent advances in protein engineering.

CH604 양자화학 II (Quantum Chemistry II) 3:0:3(3)

This course presents molecular spectroscopy and modern quantum chemistry with main emphases on the understanding of modern electronic structure calculations.
Topics include : Brief review of rudimentary Quantum Mechanics, Atomic spectra, Rovibronic spectra of diatomic molecules, Rovibronic spectra of polyatomic molecules, Magnetic resonance spectroscopy, Modern spectroscopy, Ab initio MO calculations and Semi-empirical MO calculations.

CH605 통계열역학 II (Statistical Thermodynamics II) 3:0:3(3)

This course presents a rigorous treatment of classical statistical mechanics with the application to real systems followed by the recent theory of critical phenomena.

CH606 화학동력학 (Chemical Reaction Dynamics) 3:0:3(3)

This course is designed to give graduate students in Physical Chemistry major an ability to interpret chemical and physical observations of reaction chemical species and to predict their behavior in

different environments. Topics include: Basic concepts of elementary reactions, Molecular collisions, Reaction scattering, and Molecular energy transfer.
Prerequisites by Topic: Chemical Kinetics, CH417 and Calculus and differential equations, operational mathematics, and matrix algebra.

CH607 표면화학 (Surface Chemistry) 3:0:3(3)
This course treats chemical and physical phenomena taking place at the surface and interfaces. The structural, electrical, thermodynamic, and mechanical properties of surfaces will be shown. Various surface analytic techniques including spectroscopy and microscopy will be described.

CH609 전기화학 (Electrochemistry) 3:0:3(3)
This course is designed to provide graduate students in Chemistry with insight into electrode processes in various electrochemical excitation situations. The principal purpose is to apply this knowledge to the study of various electrochemical properties and analysis of compounds. Topics covered are: basic principles and applications for the study of electrochemical properties and analysis of compounds.

CH610 구조생화학 (Structural Biochemistry) 3:0:3(3)
In this class we will discuss theoretical background and practical application of NMR and x-ray crystallographic techniques used for structural studies of biological macromolecules.

CH626 천연물화학 (Natural Products) 3:0:3(3)
This course is designed to acquaint the graduate student with isolations, purifications and structural elucidations, and total syntheses of various interesting biologically active natural products. Isolation and structural determination of natural products are introduced. Organic synthesis of natural products in selected topics such as antibiotics, toxins, proteins, steroids, and various alkaloids is introduced.

CH627 헤테로고리화학 (Heterocyclic Chemistry) 3:0:3(3)
This course is designed to give graduate students a grasp of topics surrounding the synthesis and characterization of heterocycles and utilization of heterocycles for general organic syntheses. The effects of hetero-atoms on reactivity will be discussed. The course also deals with some topics such as the synthesis and characterization of heterocyclic compounds, and how to use these compounds for organic synthesis.

CH628 유기금속반응 (Organometallic Reactions) 3:0:3(3)
This course involves a systematic survey of organic reactions regarding organometallics particularly organotransition metal complexes including addition, elimination, insertion, and oxidation / reduction reactions.

CH632 유기입체화학 (Stereochemistry of Organic Chemistry) 3:0:3(3)
This course is designed to intoduce graduate students to the study of reaction mechanisms, the determination of relative configurations and the synthesis of optically active comppunds. Topics include: Fundamental comprehension of sterochemistry in organic chemistry, resolution, asymmetric synthesis, stereocontrolled organic reactions and new chiral auxilliaries.

CH644 생무기화학 (Bioinorganic Chemistry) 3:0:3(3)

This course is designed to discuss the role of metal ions in biological processes observed in biological systems. Metallobiomolecules which will be discussed in detail include metalloproteins for electron transport, oxygen binding, and metal transport and storage, metalloenzymes for various functions of hydrolation, redox-reaction, and isomerization, and non-proteins for photo-redox and metal-ion transport and storage. The role of metal in medicine and environment as well as synthetic model approach to metallobiomolecules will be also emphasized.

CH645 촉매화학 (Catalysis Chemistry) 3:0:3(3)

This course is designed to introduce graduate students in Chemistry and Chemical Engineering to fundamental concepts of heterogeneous catalysts and to illustrate various aspects of homogeneous and heterogeneous catalysis research.

Topic include: Catalytic activities of transition metal systems, Heterogeneous Catalysis, Catalytic cycles, Ligand systems.

CH646 재료화학 (Materials Chemistry) 3:0:3(3)

This class will introduce the current trends in materials researches including organometallic catalysts, molecular materials, and nanostructured and hybrid materials on the basis of basic concepts in inorganic chemistry. I will also deal with synthesis, analysis, and application methods for materials systematically.

CH671 유기고분자화학 (Chemistry of Organic High Polymers) 3:0:3(3)

This course is designed to give graduate students in Chemistry a survey of the synthesis and reactions of organic polymers and their physical characterization including kinetics of radical species and condensation polymerization, stereochemistry of polymers, ionic polymerizations and other organic chemistry of polymers.

CH672 특성고분자화학 (Specialty Polymer Chemistry) 3:0:3(3)

This course involves synthesis and properties of photonically and electronically functional polymers. Focus is on conducting polymers, photoconducting polymers, photoresponsive polymers, nonlinear optical polymer, electroluminescent polymers, polymer batteries, and photoresists.

CH673 고분자물리화학 (Polymer Physical Chemistry) 3:0:3(3)

This course involves thermodynamic analysis of structure and properties of polymer systems. The focus here is on polymer structure, thermodynamics of polymer solutons, elasticity of rubber, phase equilibrium, friction, and transport processes.

CH674 유기전자소재화학 (Organic Electronic Materials) 3:0:3(3)

The course provides the basic principles, various organic and polymeric materials as well as their syntheses and the device fabrications of organic thin-film transistor, organic light-emitting diode and organic photovoltaic cell which are strongly connected with industrial fields.

CH675 리소그래피개론 (Introduction to Lithography) 3:0:3(3)

Lithography is applied widely to manufacturing of semiconductor microchips, displays, and MEMS devices. This course discusses the physics of lithographic process, resist processing, and emerging lithographic thechnologies such as nanoimprint lithography, interference lithography, immersion lithography, and scanning probe lithography.

CH683 세포생화학 (Cell Biochemistry) 3:0:3(3)

As a continuation of Advanced Biochemistry (CH581) in the spring semester, this course aims to understand various aspects of biological processes. Gene structure and regulation will be lectured and recent research articles will be critically discussed.

CH711 물리화학특강I (Special Topics in Physical Chemistry I) 3:0:3(3)

This course is designed to give students exposure to "hot topics" and recent advancements in the field of gas and liquid phase studies through lectures and seminars. The formal structure of this course combines lectures by the instructor as well as seminars contributed by students.

CH712 물리화학특강 II (Special Topics in Physical Chemistry II) 3:0:3(3)

This course is designed to give students exposure to "hot topics" and recent advancements in the field of solid phase and surface studies through lectures and seminars. The formal structure of this course combines lectures by the instructor as well as seminars contributed by students.

CH713 물리화학특강 III (Special Topics in Physical Chemistry III) 3:0:3(3)

This course is designed to give students exposure to "hot topics" and recent advancements in the field of theoretical and computational studies through lectures and seminars. The formal structure of this course combines lectures by the instructor as well as seminars contributed by students.

CH733 유기화학특강 I (Special Topics in Organic Chemistry I) 3:0:3(3)

This course covers special topics in physical organic chemistry such as mechanisms of new organic reactions, molecular dynamics, chemical structures and reactivity, and new molecular orbital calculations.

CH734 유기화학특강 II (Special Topics in Organic Chemistry II) 3:0:3(3)

This course involves the study of recent research papers in the aim to acquire various synthetic strategies applicable in synthesizing organic compounds such as terpenoid, macrolide, alkaloid, carbohydrate, and heterocyclic compounds. Based on this new knowledge, students are expected to apply new tools in their own studies and to develop their creativity in their research. The formal structure of this course involves lectures by the instructor as well as seminars contributed by students.

CH735 유기화학특강 III (Special Topics in Organic Chemistry III) 3:0:3(3)

This course involves the study of electron rearrangements in various chemical functional groups and the progression of chemical properties due to structural changes. Mechanisms of many biologically active compounds are considered in great depth and the synthesis of new compounds and their synthetic strategies are studied.

CH746 무기화학특강 I (Special Topics in Inorganic Chemistry I) 3:0:3(3)

This course is designed to texpand on recent "hot topics" in inorganic chemistry through lectures and seminars in the aim to increase students' exposure to broader fields other than their immediate research interests.

CH747 무기화학특강 II (Special Topics in Inorganic Chemistry II) 3:0:3(3)

This course is designed to involve in-depth study of a special topic, such as crystallography and inorganic structure. The formal structure of this course may involve seminars contributed by students and case studies in addition to the normal lectures.

CH773 고분자화학특강 I (Special Topics in Polymer Chemistry I) 3:0:3(3)
This course is composed of lectures on special topics selected from recent "hot topics" in polymer chemistry. The topics include synthetic metals, liquid crystals, photonic polymers, degradable polymers, thermoresistant polymers and new materials.

CH774 고분자화학특강 II (Special Topics in Polymer Chemistry II) 3:0:3(3)
This course involves an in-depth study of molecular weight distribution, degrees of freedom, structural regularity, determination of micro-structures, and the relationship between chemical structure and polymer properties.

CH782 생화학특강 I (Special Topics in Biochemistry I) 3:0:3(3)
This course involves lectures on special topics selected from recent hot topics in nucleic acid biochemistry and discussions through seminars. Topics including the properties and structures of nucleic acids, gene structure and function, gene expression, gene recombination, and their applications will be covered.

CH783 생화학특강 II (Special Topics in Biochemistry II) 3:0:3(3)
This course develops selected recent "hot topics" in protein biochemistry and discussions through seminars. Topics include the physical and chemical properties of proteins, protein structure, protein purification, the formation of the protein-ligand complexes, enzyme reaction theory and enzyme reaction mechanisms.

CH881 고급화학특강 I (Advanced Special Topic in Chemistry I**) 1:0:1(0)**

CH882 고급화학특강 II (Advanced Special Topic in Chemistry II**) 2:0:2(0)**

CH960 논문연구(석사) (M.S. Thesis)

CH966 세미나(석사) (M.S. Seminar) 1:0:1

CH980 논문연구(박사) (Ph.D. Thesis)

CH986 세미나(박사) (Ph.D. Seminar) 1:0:1