Course Requirements

❑ Undergraduate Courses

A. Graduation Credits : at least 130 credits in total

※ A cumulative grade point average of 2.0 or higher out of a possible 4.3 in all coursework

B. General Course : At least 27 credits and 9AU(applicable to students entering KAIST in 2009 and onward; for those who have entered KAIST before 2009, refer to the Course Completion Requirements by Year of Admission)

◦ Mandatory General Course

- Students entering KAIST in 2009 and onward : 6 credits and 9AU
  English Communication(1), Critical Thinking in English(2), Writing(3), Physical Education(4AU), Community Service(2AU), Humanity/Leadership(2AU), Ethics and Safety II (1AU)
- Students entering KAIST between 2007 and 2008 : 7 credits and 9AU
  English Communication I(1), English Communication II(1), English Reading&Writing(2), Writing(3), Physical Education(4AU), Community Service(2AU), Humanity/Leadership(2AU), Ethics and Safety II (1AU)

* English Communication I → English Communication
English Communication II → English Conversation
English Reading&Writing → Critical Thinking in English

◦ Elective General Course in Humanities & Social Science : at least 21 credits

- Students entering KAIST in 2009 and onward : at least 21 credits including at least 1 course in each of 2 divisions among 3 divisions(Humanity, Society, Culture & Art)
- Students having entered KAIST before 2009 : at least 21 credits including at least 1 course in each of 2 divisions among 5 divisions(Science Technology; Literature and Art; History and Philosophy; Social Science; Foreign Language and Linguistics) or at least 1 course in each of 2 divisions among 3 divisions(Humanity, Society, Literature&Art)
- Students entering KAIST in 2007 and onward should earn at least 18 credits through English lectures among the 21 credits required as Elective General Courses in Humanities & Social Science.

※ Students having a double major take 12 credits without considering categories. (Students entering KAIST in 2007 and onward should take 12 credits through English lectures.)

C. Completion of Basic Courses: at least 32 credits (applicable to students entering KAIST in 2008 and onward; for those who have entered KAIST before 2009, refer to the Course Completion Requirements by Year of Admission)

◦ Mandatory Basic Courses: 26 credits

① 1 course among Fundamental Physics I (3), General Physics I (3), and Advanced Physics I (3)
② 1 course among Fundamental Physics II (3), General Physics II (3), and Advance Physics II (3)
③ 1 course of General Physics Lab I (1)
④ 1 course of Basic Biology (3) or General Biology (3)
⑤ 1 course of Calculus I (3) or Honor Calculus I (3)
⑥ 1 course of Calculus II (3) or Honor Calculus II (3)
⑦ 1 course among Basic Chemistry (3), General Chemistry I (3), and Advanced Chemistry (3)
⑧ 1 course of General Chemistry Lab I (1) or Advanced Chemistry Lab (1)
⑨ 1 course of Basic Programming (3) or Advanced Programming (3)
⑩ Freshman Design Course : Introduction to Design and Communication (3)

※ Students having entered KAIST in 2007 or before : 23 credits (①~⑨)

◦ Elective Basic Courses: at least 6 credits (including at least two courses: CH103 and CH104)

※ Students with a double major take 3 credits or above including CH103

D. Major Course : at least 42 credits
  ◦ Mandatory Major Course : at least 18 credits
    Physical Chemistry I, Organic Chemistry I, Analytical Chemistry, Inorganic Chemistry I, Chemistry Lab. I, II
  ◦ Elective Major Courses : at least 24 credits
E. Elective Course
F. Research Course :
  ◦ Please be sure to take 3 credit hours of graduation research.
  ※ Students having a double major are exempt.
G. English Proficiency Requirements upon Graduation
  ◦ Students are required to meet one of the following requirements on English proficiency before entering KAIST or during their years of enrollment: 560 points in PBT TOEFL; 220 points in CBT TOEFL; 83 points in IBT TOEFL; 6.5 points in IELTS; 720 points or 760/775 points in TOEIC (see below); or 599 points or 670/690 points in TEPS (see below).

※ Criteria for TOEIC and TEPS scores
- Students submitting scores from new TOEIC (held in May 2006 and onward) or TEPS held on March 1, 2007 and onward: 720 points in TOEIC; or 599 points in TEPS
- Students submitting scores from old TOEIC (held before April 2006) or TEPS held before February 28, 2007:
  ▫ Students entering KAIST in 2008 and onward: 775 points in TOEIC; or 690 points in TEPS
  ▫ Students entering KAIST in 2007 or before: 760 points in TOEIC; or 670 points in TEPS

※ Requirements for a double major : 40 credits including mandatory major courses

※ Requirements for a minor : at least 21 credits including 12 credits of mandatory major courses

※ General and basic courses in undergraduate program are different from years of admission; therefore, students entering KAIST before 2009 should refer to the Course Completion Requirements by Year of Admission.

❑ Master's Program

1) Thesis Master's Degree
  A. Graduation Credits : at least 33 credits
  B. Mandatory General Course : 3 credits and 1AU
    - CC010 Special Lecture on Leadership(non-credit, this applies to students entering KAIST in 2002 and onward; general scholarship students, foreign students are excluded)
    - CC020 Ethics and Safety I(1AU)
  C. Mandatory Major Course : None
  D. Elective Course : at least 18
    - Mandatory : 9 credits (500 levels from more than two subfields)
    - Elective : at least 9 credits
  E. Research Credits : at least 12 credits (including seminar credits)

❑ **Doctoral Program**

A. Graduation Credits : at least 60 credits

B. Mandatory General Course : 3 credits and 1AU

- CC010 Special Lecture on Leadership(non-credit, this applies to students entering KAIST in 2002 and onward; general scholarship students, foreign students are excluded)
- CC020 Ethics and Safety I(1AU)

C. Mandatory Major Course : None

D. Elective Course : at least 18

- Mandatory : 9 credits(500 levels from more than two subfields)
- Elective : at least 9 credits

E. Research Credits : at least 39 credits (including seminar credits)

※ The course credits earned in the Master's course work can be used towards the Doctoral degree(except research credits).

3. Curriculum

❒ Undergraduate Program

Classification	Subject No.	Subject Name	Lecture:Lab.:Credit (Homework)	Semester	Remark
Mandatory Major Course	CH211	Physical Chemistry I	3:0:3(3)	Spring	
	CH221	Organic Chemistry I	3:0:3(3)	Spring	
	CH241	Inorganic Chemistry I	3:0:3(3)	Spring	
	CH251	Chemical Experiment I	0:9:3(3)	Fall	
	CH261	Analytical Chemistry	3:0:3(3)	Spring	
	CH351	Chemical Experiment II	0:9:3(3)	Spring	
Elective Major Course	CH213	Physical Chemistry II	3:0:3(3)	Fall	
	CH223	Organic Chemistry II	3:0:3(3)	Fall	
	CH242	Inorganic Chemistry II	3:0:3(3)	Fall	
	CH315	Physical Chemistry III	3:0:3(3)	Spring	
	CH325	Bioorganic Chemistry	3:0:3(3)	Spring	
	CH336	Physical Organic Chemistry	3:0:3(3)	Fall	
	CH381	Biochemistry I	3:0:3(3)	Fall	
	CH416	Introduction to Molecular Spectroscopy	3:0:3(3)	Spring or Fall	**
	CH417	Chemical Reaction Dynamics	3:0:3(3)	Fall	**
	CH418	Computational Chemistry	3:0:3(3)	Spring	**
	CH419	Introduction to Solid-State Chemistry	3:0:3(3)	Spring or Fall	**
	CH437	Organic Structure Analysis	3:0:3(3)	Fall	**
	CH438	Organic Reactions and Synthesis	3:0:3(3)	Spring	**
	CH444	Inorganic Materials Chemistry	3:0:3(3)	Spring	
	CH450	Chemical Writing and presentation	3:0:3(3)	Spring	**
	CH451	Advanced Chemistry Lab.	0:6:2(3)	Spring,Fall	
	CH463	Instrumental Analysis	3:0:3(3)	Fall	**
	CH471	Polymer Chemistry	3:0:3(3)	Fall	**
	CH482	Biochemistry II	3:0:3(3)	Spring	
Research	CH 490	Graduation Research	0:6:3		
	CH 495	Independent Study	0:6:1		
	URP 490	URP(B)	0:6:3		
	URP 495	URP(A)	0:6:1		

** This course can be taken by students in either undergraduate or master's program.

❒ Graduate Program

Classification		Subject No.	Subject Name	Lecture:Lab.:Credit (Homework)	Semester	Remark
Mandatory General Course	Mandatory	CC010	Special Lecture on Leadership	1:0:0	Fall	
		CC020	Ethics and Safety I	1AU	Spring·Fall	
	Choose 1	CC500	Scientific Writing	3:0:3	Spring·Fall	
		CC510	Introduction to Computer Application	2:3:3	Spring·Fall	
		CC511	Probability and Statistics	2:3:3	Spring·Fall	
		CC512	Introduction to Materials and Engineering	3:0:3	Spring·Fall	
		CC513	Engineering Economy and Cost Analysis	3:0:3	Fall	
		CC522	Introduction to Instruments	2:3:3	Fall	
		CC530	Entrepreneurship and Business Strategies	3:0:3	Fall	
		CC531	Patent Analysis and Invention Disclosure	3:0:3	Spring·Fall	
		CC532	Collaborative System Design and Engineering	4:0:4	Spring	
Elective Major Course		CH502	Quantum Chemistry I	3:0:3(3)	Spring	**
		CH503	Statistical Thermodynamics I	3:0:3(3)	Fall	**
		CH521	Advanced Organic Chemistry	3:0:3(3)	Spring	
		CH522	Organic Synthesis I	3:0:3(3)	Spring	**
		CH523	Organic Synthesis II	3:0:3(3)	Fall	
		CH541	Advanced Inorganic Chemistry	3:0:3(3)	Spring	**
		CH542	Organometallic Chemistry	3:0:3(3)	Fall	**
		CH581	Advanced Biochemistry	3:0:3(3)	Spring	
		CH582	Protein Chemistry	3:0:3(3)	Fall	**
Elective Course		CH604	Quantum Chemistry II	3:0:3(3)	Spring or Fall	
		CH605	Statistical Thermodynamics II	3:0:3(3)	〃	
		CH606	Chemical Reaction Dynamics	3:0:3(3)	〃	
		CH607	Surface Chemistry	3:0:3(3)	〃	
		CH609	Electrochemistry	3:0:3(3)	〃	
		CH610	Structural Biochemistry	3:0:3(3)	〃	
		CH626	Natural Products	3:0:3(3)	〃	
		CH627	Heterocyclic Chemistry	3:0:3(3)	〃	
		CH628	Organometallic Reactions	3:0:3(3)	〃	
		CH632	Stereochemistry of Organic Chemistry	3:0:3(3)	〃	
		CH644	Bioinorganic Chemistry	3:0:3(3)	〃	
		CH645	Catalysis Chemistry	3:0:3(3)	〃	
		CH646	Materials Chemistry	3:0:3(3)	〃	
		CH671	Organic Chemistry of High Polymers	3:0:3(3)	〃	
		CH672	Specialty Polymer Chemistry	3:0:3(3)	〃	
		CH673	Polymer Physical Chemistry	3:0:3(3)	〃	
		CH674	Organic Electronic Materials	3:0:3(3)	〃	
		CH675	Introduction to Lithography	3:0:3(3)	〃	
		CH711	Special Topics in Physical Chemistry I	3:0:3(3)	〃	
		CH712	Special Topics in Physical Chemistry II	3:0:3(3)	〃	
		CH713	Special Topics in Physical Chemistry III	3:0:3(3)	〃	
		CH733	Special Topics in Organic Chemistry I	3:0:3(3)	〃	
		CH734	Special Topics in Organic Chemistry II	3:0:3(3)	〃	
		CH735	Special Topics in Organic Chemistry III	3:0:3(3)	〃	
		CH746	Special Topics in Inorganic Chemistry I	3:0:3(3)	〃	
		CH747	Special Topics in Inorganic Chemistry II	3:0:3(3)	〃	
		CH773	Special Topics in Polymer Chemistry I	3:0:3(3)	〃	
		CH774	Special Topics in Polymer Chemistry II	3:0:3(3)	〃	
		CH782	Special Topics in Biochemistry I	3:0:3(3)	〃	
		CH783	Special Topics in Biochemistry II	3:0:3(3)	〃	
		CH791	Special Topics in Contemporary Chemistry I	3:0:3(3)	〃	
		CH792	Special Topics in Contemporary Chemistry II	3:0:3(3)	〃	

Research	CH 960	Thesis / Dissertation Research (Master)			
	CH 980	Thesis / Dissertation Research (Doctoral)			
	CH 966	Seminar (Master)	1:0:1		
	CH 986	Seminar (Doctoral)	1:0:1		

** This course can be taken by students in either undergraduate or master's program.

4. Description of Courses

CH211 Physical Chemistry I
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 Physical Chemistry II
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 Organic Chemistry I
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 Organic Chemistry II
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

CH241 Inorganic Chemistry I
This course is designed to give juniors in chemistry a modern insight into inorganic chemistry with a good balance between theory, descriptive chemistry, and applications. The principal purpose is to instill the fundamental concepts regarding chemical bonds, molecular symmetry, physical methods in inorganic chemistry, coordination, and organometallic chemistry of transition elements. Topics include : theoretical basis, molecular structure, analytical methods, coordination chemistry, and advanced topics in coordination chemistry.

CH242 Inorganic Chemistry II
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

CH251 Chemistry Lab. I
This course designed for students majoring in Chemistry to practice the basic techniques of chemical experiments especially in the organic and analytical field. About 4 topics are assigned to analytical chemistry such as titration and spectroscopic analysis. The rest of the class is consisted of organic reactions such as oxidation and C-C bond-forming reactions, which are essential parts of organic transformations.

CH261 Analytical Chemistry
This course provides juniors in chemistry with a rigorous background in chemical principles that is particularly important to analytical chemistry and gives an appreciation for the challenging task of judging the accuracy and precision of experimental data.
Prerequisites by topic : Strong and weak electrolytes, Acid and base concepts including strength, Unit of weight and concentration (moles, formula weight, percent (w/w), volume percent (v/v) etc.). Stoichiometric relationship, Equilibrium concept and equilibrium constant calculation.

CH315 Physical Chemistry III
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 Bioorganic Chemistry
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 Physical Organic Chemistry
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.

CH381 Biochemistry I
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.

CH416 Introduction to molecular spectroscopy
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 Chemical Reaction Dynamics
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 Computation Chemistry
This course covers numerical methods for molecular mechanics, the principle of molecular dynamics and the Monte Carlo method.

CH419 Introduction to Solid-State Chemistry
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 Organic Spectroscopy
This course is designed to give students in chemical science an understanding of spectroscopic methods of structure determination and qualitative analysis in organic chemistry.

CH438 Organic Spectroscopy
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.

CH444 Inorganic Materials Chemistry
This calss will describe the structures and related physical and chemical properties of inorganic compounds. The main themes are chemical applications of group theory, defect structures and properties of solid materials, and current trends in inorganic chemistry.

CH450 Chemical Writing and Presentation
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 Advanced Chemistry Lab.
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.

CH463 Instrumental Analysis
This course is designed to give seniors and graduate students in chemistry an insight into a variety of spectroscopic instruments and separation techniques. The principal purpose of this course is to give an appreciation for modern instrumentation and to explain how to analyze transduced instrumental signals. Topics include basic principles and analysis of spectra of spectroscopic methods (NMR, IR, UV, Mass, X-ray, etc.) and separation techniques (GC, HPLC).

CH471 Introduction to Polymer Chemistry
This course is designed to introduce polymer chemistry at the advanced undergraduate level for students with a background in organic chemistry. Topics include : concepts of polymerization reaction mechanisms, kinetics and stereochemistry. Prerequisites by topic : Organic Chemistry I

CH482 Biochemistry II
This course is designed to teach the biosynthesis of macromolecules and their precursors, and the chemical, physiological, and genetical aspects of regulation of biosynthesis. This is a continuation of Biochemistry I (CH381).

CH502 Quantum Chemistry I
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 Statistical Thermodynamics I
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.

CH521 Advanced Organic Chemistry I
The 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 Organic Synthesis
The lecture covers carbon-carbon bond formation of organic syntheses including alkylation, aldol condensation, free radical reaction rearrangement and cycloaddition reaction.

CH523 Organic Synthesis II
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 Advanced Inorganic Chemistry
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 Organometallic Chemistry
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 Advanced Biochemistry
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 Protein Chemistry
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 Quantum Chemistry II
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 Statistical Thermodynamics II
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 Molecular Reaction Dynamics
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 Surface Chemistry
This course is designed to give high-level understanding to the Chemistry of solids, mainly metal and gas-solid interface structures. Thermodynamics and dynamics of the solid surface are discussed with a brief introduction to solid state dynamics. The main area of study is the absorption and deabsorption of gas molecules on metal surfaces and implications of these phenomena to the theory of catalytic behavior.
Topic include : Principle of the surface analysis methods such as Auger, XPS, LEED, SEXAFS, Chemisorption on surfaces, and Catalytic reactions on surfaces.

CH609 Electrochemistry
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 Structural Biochemistry
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 Natural Product Chemistry
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 Heterocyclic Chemistry
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 Organometallic Chemistry
This course involves a systematic survey of organic reactions regarding organometallics particularly organotransition metal complexes including addition, elimination, insertion, and oxidation / reduction reactions.

CH632 Stereochemistry
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 Bio-Inorganic Chemistry
This graduate course is designed to cover the role of metal ions in biological processes observed in biological systems. Metallobiomolecules which will be discussed in detail include enzymes, transport and storage proteins, non-proteins etc. Synthetic model approaches will be emphasized. Prerequisites by topic : Inorganic Chemistry and Analytical Chemistry.

CH645 Catalysis Chemistry
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 Materials Chemistry
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 Organic Chemistry of High Polymers
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 Specialty Polymer Chemistry
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 Polymer Physical Chemistry
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 Organic Electromic Materials
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 Introduction to Lithography
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.

CH711 Special Topics in Physical Chemistry I
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 Special Topics in Physical Chemistry II
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 Special Topics in Physical Chemistry III
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 Special Topics in Organic Chemistry I
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 Special Topics in Organic Chemistry II
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 Special Topics in Organic Chemistry III
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 Special Topics in Inorganic Chemistry I
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 Special Topics in Inorganic Chemistry II
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 Special Topics in Polymer Chemistry I
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 Special Topics in Polymer Chemistry II
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 Special Topics in Biochemistry I
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 Special Topics in Biochemistry II
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.

CH791 Special Topics in Contemporary Chemistry I
This course involves recent research trends in all chemical research areas; in particular, joint research among chemistry, life science and material science, are systematically covered.

CH792 Special Topics in Contemporary Chemistry II
Following from CH791, this course involves further recent research trends in all chemical research areas, again focusing systematically on joint research efforts among chemistry, life science and material science.