

II Department of Convergence Sciences II

| Educational Purposes |

Based on the philosophical foundation of Christian education of the whole person, Chemistry, Life Science, Animal Behavior Science, Computer Engineering, Food Science, and their cutting-edge technologies in each academic area, such as IT, BT, and NT, are converged into green bio industrial technology, fostering future-oriented talents equipped with character and creativity to lead the 4th industrial revolution,

Also, through the convergence of science, technology and society, the Convergence Science Department aims to train scientific experts to serve the university, community and the country, and lead the health and welfare of mankind in the 21st century.

| Educational Objectives |

1. To nurture natural science-related researchers, educators, and leaders through research and development for truth-seeking based on the basic knowledge of cutting-edge science.
2. To enhance the ability to use research products academically, industrially, and economically by educating students to develop original technologies and secure intellectual property rights through the cultivation of research capabilities.
3. To develop creativity and originality required for research and development of advanced bioengineering technology, and cultivate the ability to collect, analyze, interpret, and synthesize data for this purpose.
4. To prepare industrial demand caused by the 4th industrial revolution and nurture convergence science experts who can lead the future industry by converging advanced technologies related to IT, BT, and NT,

| Bylaws |

Article 1 (Majors)

The majors of this department include Chemistry, Life Science, Animal Behavior Science, Computer Engineering in the master's and M&D combined program, and Chemistry, Life Science, Animal Behavior Science, Computer Engineering

and Food Science majors in the doctoral program.

Article 2 (Admissions)

Matters related to the admissions comply with the Graduate School Regulations and its Bylaws.

Article 3 (Curriculum)

- ① Major courses to be taken are designated by the academic advisor.
- ② Under the guidance of the academic advisor, students may take up to 12 credits of courses from other departments of Sahmyook University Graduate School, that are closely related to the department.

Article 4 (Credits and Graduation Requirements)

The Students must complete the coursework according to the curriculum and earn the required number of credits. Also, students must obtain the qualification for submitting the thesis/dissertation by passing a foreign language test and comprehensive examination and pass the thesis/dissertation review.

- ① For the master's program, students must earn at least 3 credits of common essential courses and 24 credits of elective major courses.
- ② For the doctoral program, students must earn at least 6 credits of common essential courses and 36 credits of elective major courses.
- ③ For the M&D combined program, students must earn at least 6 credits of common essential courses and 51 credits of elective major courses.
- ④ The common essential courses can be replaced with course(Science in the Bible) designated by the department.

Coursework	Master's Program (Credits)	M&D Combined Program (Credits)	Doctoral Program (Credits)
Common essential Courses	3	6	6
Elective Major Courses	21	51	36
Thesis/Dissertation	P	P	P
In Total	24	57	42

Article 5 (Foreign Language Test)

Matters related to the foreign language test comply with the Graduate School Regulations and its Bylaws.

Article 6 (Comprehensive Examination)

- ① Matters related to the comprehensive examination comply with the Graduate School Regulations and its Bylaws.
- ② The test subjects are three major subjects designated by the advisor.

Article 7 (The Thesis/Dissertation)

- ① Matters related to the academic advisor and thesis/dissertation comply with the Graduate School Regulations and its Bylaws.
- ② The master's thesis can be replaced by a paper submitted to an international journal or higher journals (SCI, SCIE, SCOPUS level) with the student as the first author and the academic advisor as the corresponding author.
- ③ The students pursuing the doctoral degree must publish at least two papers as the first author in international journals or higher journals (SCI, SCIE, SCOPUS level) to be eligible to apply for the dissertation review.

Article 8 (Department of Convergence Science Committee of the Graduate School)

- ① Purpose: The Committee of the Convergence Science Department of the Graduate School is established to comprehensively review important matters related to the operation of the Graduate School and important matters of the Convergence Science Department.
- ② Composition: The Committee of the Convergence Science Department of the Graduate School is composed of the department chair and department professors, and the department chair acts as the chairperson.
- ③ Term of Office: The term of office of the chairperson is consistent with the term of office of the department chair.
- ④ Function: The Committee of the Convergence Science Department of the Graduate School discusses, deliberates, and decides on the following matters.
 1. Matters concerning the establishment and revision of educational objectives
 2. Organization and revision of the department's curriculum
 3. Planning and execution of academic activities for graduate students
 4. Matters related to the admission and graduation
 5. Matters related to thesis/dissertation guidance
 6. Appointment of thesis/dissertation advisors and reviewers
 7. Matters concerning foreign language test and comprehensive examination
 8. Selection of scholarship recipients
 9. Matters concerning department budget
- ⑤ Meetings: The committee is convened by the chairperson when the chairperson deems it necessary, and the meeting of the committee is opened with the attendance of a majority of the members present, and resolutions are made with the consent of a majority of the members present. The chairperson has the same voting rights as the members.

Article 9 (Student Council)

The student Council of the Department of Convergence Science, an autonomous organization that promotes research and cooperation among students, can be organized.

Article 10 (Mutatis Mutandis)

Matters not specifically stipulated in these bylaws comply with the Graduate School Regulations.

| Curriculum |

Common

Course No.	Course Title	Credits
2002133	논문지도 I (Thesis Research I)	3
2002134	논문지도 II (Thesis Research II)	3
2003076	논문 (M.S.) (Thesis for M.S. in Convergence Science)	P
2003077	논문 (Ph.D.) (Dissertation for Ph.D. in Convergence Science)	P
2002854	성경속의 과학(Science in the Bible)	3

Chemistry

Course No.	Course Title	Credits
2000148	고급기기분석 (Advanced Instrumental Analysis)	3
2000149	고급무기화학 (Advanced Inorganic Chemistry)	3
2000150	고급물리화학 (Advanced Physical Chemistry)	3
2000151	고급분석화학 (Advanced Analytical Chemistry)	3
2000158	고급유기화학 (Advanced Organic Chemistry)	3
2000170	고분자물리화학 (Polymer Physical Chemistry)	3
2000171	고분자유변학 (Polymer Rheology)	3
2000172	고체물성 특론 (Special Topics in Solid State Chemistry)	3
2000330	나노화학특론 (Special Topics in Nano Chemistry)	3
2000456	무기화학특론 (Special Topics in Inorganic Chemistry)	3
2000570	분석화학특론 (Special Topics in Analytical Chemistry)	3
2000700	생체재료학 (Study in Biomaterials)	3
2001072	유기분광학 (Organic Spectroscopy)	3
2001073	유기합성 (Organic Synthesis)	3
2001074	유기합성특수연구 (Research in Organic Synthesis)	3
2001077	유기화학특론 (Special Topics in Organic Chemistry)	3
2001422	통계열역학 (Statistical Thermodynamics)	3
2001510	화학반응속도론 (Chemical Reaction Kinetics)	3
2001511	화학분리 (Chemical Separation)	3
2002595	융합과학세미나 I (Seminar in Convergence Science I)	1
2002596	융합과학세미나 II (Seminar in Convergence Science II)	1
2002597	융합과학세미나 III (Seminar in Convergence Science III)	1
2002598	융합과학세미나 IV (Seminar in Convergence Science IV)	1
2001893	물리유기화학 (Physical Organic Chemistry)	3
2001894	유기금속화학 (Organometallic Chemistry)	3
2001895	화학기기학 (Chemical Instrumental Analysis)	3
2001896	전기분석 (Electrochemical Analysis)	3
2001897	화학열역학 (Chemical Thermodynamics)	3
2001898	양자화학 (Quantum Chemistry)	3
2001899	분자분광학 (Molecular Spectroscopy)	3

2001901	착물화학 (Complex Chemistry)	3
2001902	무기분석화학 (Inorganic Analytical Chemistry)	3
2001906	고분자화학 반응속도론 (Chemical Kinetics of Polymerization)	3
2001908	환경화학 (Environmental Chemistry)	3
2001909	방사화학 (Radiation Chemistry)	3
2002174	나노소재 화장품화학 (Nano Materials Cosmetic Chemistry)	3
2001995	생유기화학 (Bioorganic Chemistry)	3
2002310	고급나노화학 (Advanced Nano-chemistry)	3
2002490	약물전달학 (Study in Drug Delivery)	3
2002491	고급 양자화학 (Advanced Quantum Chemistry)	3
2002533	에너지소재공학 (Energy Materials Engineering)	3
2002570	나노과학기술 입문 (Introduction to Nano-science and Technology)	3
2002571	융합과학기술개론 (Introduction to Convergence Science and Technology)	3
2002572	나노융합기술 및 환경 (Nano Convergence Technology and Environment)	3
2002573	나노생명과학론 (Nano-bioscience)	3
2002574	나노소재화학 (Nano-chemistry and Material Science)	3
2002576	바이오센싱 (Sensing in Bioengineering)	3
2002577	광전자재료응용 (Photonic Materials and Application)	3

Life Science

Course No.	Course Title	Credits
2000487	미생물학 특론 (Advanced Microbiology)	3
2000575	분자생물학 특론 (Advanced Molecular Biology)	3
2000580	분자유전학 특론 (Advanced Molecular Genetics)	3
2000685	생물공학 특론 (Advanced Biotechnology)	3
2000706	생화학 특론 (Advanced Biochemistry)	3
2000842	식물공학 특론 (Advanced Plant Biotechnology)	3
2000848	식물조직배양학 특론 (Advanced Plant Tissue Culture)	3
2001100	유전학 특론 (Advanced Genetics)	3
2001432	특수연구 (Directed Research)	3
2001890	연구방법론 (Research Method)	3
2001892	세포생물학 특론 (Advanced Cell Biology)	3
2001914	바이러스학 특론 (Advanced Virology)	3
2001915	환경생물학 특론 (Advanced Environmental Biology)	3
2002127	세포유전학 연구론 (Research in Cytogenetics)	3
2002128	식물생명과학 연구론 (Method in Plant science)	3
2002131	세포유전학 특론 (Advanced Cytogenetics)	3
2002566	생물통계학 특론 (Advanced Statistics)	3
2002581	분자세포유전학 특론 (Advanced Molecular Cytogenetics)	3
2002584	생물정보학 특론 (Advanced Bioinformatics)	3
2002656	유전체학 특강 (Special Topics in Genomics)	3
2002657	식물학특론 (Advanced Botany)	3
2002658	식물학특강 (Special Topics in Botany)	3
2002659	분자생물학 특강 (Special Topics in Molecular Biology)	3

2002660	유전체학 특론 (Advanced Genomics)	3
2002753	유전학 특강 (Special Topics in Genetics)	3
2002754	생물정보학 특강 (Special Topics in Bioinformatics)	3
2002755	분자세포유전학 특강 (Special Topics in Molecular Cytogenetics)	3
2002824	분자유전학 특강 (Special Topics in Molecular Genetics)	3
2002825	생물공학 특강 (Special Topics in Biotechnology)	3
2002826	생화학 특강 (Special Topics in Biochemistry)	3
2002827	식물조직배양학 특강 (Special Topics in Tissue Culture)	3
2002828	연구방법론 특론 (Advanced Research Method)	3
2002829	연구방법론 특강 (Special Topics in Research Method)	3
2002830	세포생물학 특강 (Special Topics in Cell Biology)	3
2002831	세포유전학 특강 (Special Topics in Cytogenetics)	3

Animal Behavior Science

Course No.	Course Title	Credits
2000394	동물생태학연구론 (Research in Animal Ecology)	3
2000398	동물생리학 특론(Advanced Animal Physiology)	3
2000402	동물음성학 (Animal Phonetics)	3
2000405	동물행동학연구론 (Research of Animal Behavior)	3
2000560	보전생물학 (Conservation Biology)	3
2000636	사회생물학 (Social Biology)	3
2000701	생태복원공학 (Restoration Ecology and Engineering)	3
2000944	야생동물관리방법론 (Wildlife Management Techniques)	3
2001917	행동생물학특론 (Advanced Behavioral Biology)	3
2002968	동물임상병리학 (Advanced animal pathology)	3
2002969	동물관리학 특론 (Advanced animal management)	3
2002970	동물매개치료학 (Animal assisted therapy)	3
2002971	동물산업학 및 세미나 (Animal industry and seminar)	3
2002972	생명윤리학 (Bioethics)	3

Computer Engineering

Course No.	Course Title	Credits
2000835	시큐어코딩 (Secure Coding)	3
2001069	웹정보처리특론 (Advanced Web Information Processing)	3
2001999	종합정보통신망특론 (Advanced Integrated Service Digital Network)	3
2002000	고급데이터베이스 (Advanced Databases)	3
2002001	데이터베이스보안 (Database Security)	3
2002003	데이터베이스시스템특론 (Topics in Database Systems)	3
2002004	소프트웨어공학특론 (Advanced Software Engineering)	3
2002133	논문지도 I (Thesis Research I)	3
2002134	논문지도 II (Thesis Research II)	3
2002534	컴퓨터과학 특강(Special Topics in Computer Science)	3
2002552	컴파일러 구성론 (Compiler Design Theory)	3
2002554	임베디드시스템론 (Embedded System)	3
2002555	모바일시스템프로그래밍 (Mobile System Programming)	3
2002556	데이터스트림처리 (Data Stream Processing)	3
2002560	인터넷프로토콜 (Internet Protocol)	3
2002561	데이터통신이론특론 (Advanced Data Communication Theory)	3
2002562	컴퓨터그래픽스특론 (Advanced Computer Graphics)	3
2002563	멀티미디어프로그래밍특론 (Advanced Multimedia Programming)	3
2002564	컴퓨터구조특론 (Advanced Computer Architecture)	3
2002565	컴퓨터과학최신주제 (Current Issues in Computer Science)	3
2002767	운영체제특론 (Advanced Operating Systems)	3
2002836	최신모바일응용기술 (Advanced Mobile Application Technology)	3
2002837	빅데이터처리 (Big Data Processing)	3
2002838	기계학습 (Machine Learning)	3

Food Science

교과목코드	과목명	학점
2003486	고급인체생리학 (Advanced Human Physiology)	3
2003487	급식경영관리특론 II (Advanced Food Service System Management II)	3
2003489	식품기능학특론 (Special Topics in Functional Food)	3
2003492	식품영양과 면역 (Food, Nutrition and Immunity)	3
2003493	식품분석특론 (Special Topics in Food Analysis)	3
2003494	식품품질관리 및 안전성 평가 (Quality Assurance and Safety Evaluation of Food)	3
2003495	발효공학특론 II (Advanced Fermentation Technology II)	3
2003497	최신식품영양연구 (Current Topics in Food and Nutrition)	3
2001855	식품독성학 (Food Toxicology)	3
2001424	통계학 (Statistics)	3
2003089	지역사회와 식품영양 (Community Food & Nutrition)	3
2003498	병태생리학 II (Pathophysiology II)	3

| Course Information |

Science in the Bible

Scientific observation is related with the Bible story in faith and learning class based on christian world view.

Advanced Instrumental Analysis

Students learn the principles of electrochemistry, spectrochemistry, thermochemistry, and electromagnetic analysis equipment, and GC, HPLC, UV-Vis, IR, MS, NMR, ESR, and other spectroscopic analysis methods, and practice mass spectral compound identification.

Advanced Inorganic Chemistry

This course covers the contemporary concept of atoms, chemical bonding, acid-base interactions in donor-acceptor theory, inorganic compounds, synthesis of inorganic avant-garde metal compounds, spectroscopic analysis of inorganic compound structure, and simple organometallic compounds and bioinorganic chemistry.

Advanced Physical Chemistry

Molecular structure, chemical equilibrium, reaction kinetics, and molecular spectroscopic characteristics of inorganic materials are explained with general concepts of quantum chemistry.

Advanced Analytical Chemistry

This course covers theories and applications of instrumental analysis methods, such as spectrometry, electrochemical analysis, mass spectrometry, and newly developed analysis approaches, as well as separation analysis.

Advanced Organic Chemistry

This course deals with the structures of organic compounds and the mechanisms of organic reactions at an advanced level. Bond theory and stereochemistry are applied to aliphatic and aromatic compounds, respectively, as well as radical reactions and organic reaction kinetics. Equipped with the knowledge of these theories, the basic methods of organic synthesis will be tackled.

Polymer Physical Chemistry

In this course, the structure and properties of polymers are examined at the physicochemical level, as well as molecular size, chemical reactivity, shapes of polymer materials, and molecular weight measurement.

Polymer Rheology

This course covers the flow and deformation of polymer materials. In polymer

rheology, the study of determining, predicting, and analyzing rheological characteristics, students learn the viscoelasticity and rheological properties of polymeric materials, and also theories and phenomena regarding the structure, physical properties, plasticity, and molding characteristics of polymer materials.

Special Topics in Solid State Chemistry

This course aims to explore knowledge regarding strategies for preparing various inorganic solid samples including crystalline and amorphous samples, and to learn research methods for electrical, magnetic, and optical properties arising from the combination of individual samples. While dealing with these topics, students will acquire basic knowledge necessary for developing new materials.

Special Topics in Nano Chemistry

Lectures in this course include, but not limited to, basic concepts of nanochemistry, nanomaterial analysis methods, self-assembly, synthesis and chemical properties of metal nanoparticles, applications of nanoparticles, chemistry of carbon nanomaterials, bio-inorganic nanomaterials, and hybrid nanocomposites.

Thesis or Dissertation for Convergence Science

In this course, the whole process of dissertation writing is explained, which includes the design and conduct of experiments in the research field concerned, data collection, and statistical analysis.

Special Topics in Inorganic Chemistry

Lectures in this course include various theories explaining the synthesis, structure, group theory, and combination of inorganic compounds. Additionally, regarding the recent trends of inorganic chemistry, tasks selected are analyzed and observed.

Special Topics in Analytical Chemistry

Focusing on New analytical theories and methods are extensively covered with a focus on the latest research in the field of analytical chemistry.

Study in Biomaterials

Biomaterials for medical use have been developed in accordance with progress of the fields of medicine, biochemistry, material science, and pharmaceuticals and advances in the medicine have changed the concept of surgery. All the materials used in medicine should be biocompatible so that recently introduced biomaterials are designed to provide biological functions as much as possible by mimicking natural tissue structures. In this class, we will mainly study these biomaterials which are currently using in the field of medicine.

Organic Spectroscopy

This course covers the principles and applications of various rapidly advancing spectroscopic analysis instruments. That is, by learning the principles and handling of spectrophotometers (IR, UV, NMR, Mass, Fluorescence, etc.) and analytical instruments (GC, LC, etc.), students develop the ability to identify the structure of synthesized materials.

Organic Synthesis

This course covers the total synthesis of physiologically active or optically active natural products, drawing on various organic reaction theories. Additionally, by investigating and exploring the chemical development of organic synthesis, students acquire the ability to apply new reactions and creativity and develop the ability to create new materials.

Research in Organic Synthesis

In this course, professionals from specific research fields are invited to transfer their knowledge and techniques of the synthesis process in real settings in order for students to acquire theoretical knowledge and practical skills regarding the principles, methods, and applications of various technologies necessary for organic synthesis research to enhance their research capabilities.

Special Topics in Organic Chemistry

This course is offered for students to acquire a variety of knowledge bases in organic chemistry necessary for conducting research as well as studying in various postgraduate programs.

Statistical Thermodynamics

In this study, students learn how to conduct statistical analysis of chemical thermodynamics and to comparatively analyze classical results and quantum mechanical systems.

Chemical Reaction Kinetics

This course covers collision theory, absolute reaction kinetics, and reaction rate research methodology for chemical reactions, along with in-depth studies of the kinetic theory of gas molecules and random walk motion such as the Brownian trajectory.

Chemical Separation

In this course, general topics of physical and chemical separation processes are presented in great detail, and lectures are delivered on the theory and practice of chromatography.

Seminar I, II, III, & IV

In this course, presentations are given on recent research trends, research projects,

individual special topics, or research topics to be conducted in the last semester, followed by Q&A and thematic discussions on research prospects.

Physical Organic Chemistry

A range of theories underlying organic chemistry are dealt with in great detail in this course. More specifically, by studying the principles and applications of the theories of organic chemistry related to structure, reactivity, and mechanism, students can build the ability to apply the knowledge to organic reaction.

Organometallic Chemistry

This course covers the general aspects of organic reactions using metals, which have recently received considerable attention; that is, the synthesis, structure, reactivity, and catalytic properties of various organic compounds of simple or transition metals such as copper, lithium, magnesium, zinc, rhodium, palladium, and tin.

Chemical Instrumental Analysis

This course covers a large spectrum of topics regarding the devices, principles, and use of analytical instruments, such as electrochemical, spectroscopic, and chromatographic instruments.

Electrochemical Analysis

Lectures in this course include, but not limited to, potentiometric, coulometric, electrical conductivity, and planography methods, as methods to determine the concentration and structure of materials using their electrical properties.

Chemical Thermodynamics

In this course, the laws of thermodynamics are dealt with in classical and statistical thermodynamics, and the direction and equilibrium of thermodynamic chemical reactions are examined under the aspects of thermodynamic functions based on the basic principles and laws of thermodynamics.

Quantum Chemistry

This course covers the topics of general concepts of quantum chemistry, angular momentum, approximation, application of molecular structures, and quantum mechanical properties of chemical bonds.

Molecular Spectroscopy

This course covers the topics of quantum mechanical theory of molecular spectra, molecular structure and symmetry from spectral rotation and vibration, electron spectra, and nuclear magnetic resonance.

Complex Chemistry

This course covers reaction kinetics and mechanisms of complexes, stability of complex

ions, isomerism of metal complexes, catalysis, synthesis of organometallic compounds, valence bond theory, crystal field theory, and molecular orbital theory.

Inorganic Analytical Chemistry

This course covers the topics of the theory and practice of quantitative and qualitative analysis of inorganic substances.

Chemical Kinetics of Polymerization

This course covers the physicochemical reaction rate of polymer synthesis and the effects of solvents and catalysts in polymer synthesis and its reaction mechanisms.

Environmental Chemistry

This course covers the topics of sample collection, pre-treatment, simple inspection methods, and the state-of-the-art analysis methods for trace amounts of harmful substances contained in water, air, and food due to environmental pollution.

Radiation Chemistry

Lectures in this course include, but not limited to, the properties of radiation, contemporary views of natural and artificial radioactivity, chemical applications of radioactive isotopes, nuclear reactions, decay and growth of radioactivity, and interaction of radiation with matter.

Nano Materials Cosmetic Chemistry

In this course, expert knowledge is acquired on the basic principles of nanochemistry, the overall properties of nanoscale raw materials used in cosmetic functionalities, such as whitening, antiwrinkle, UV protection, and moisturizing, and their respective application fields.

Bionorganic Chemistry

In this introductory biochemistry course, students learn the basic structures and roles of carbohydrates, nucleic acids, amino acids, peptides, proteins, and lipids based on organic chemistry. These substances are the basic components of life, and have recently attracted much attention.

Thesis Research I, II

In this course, the whole process of dissertation writing is explained, which includes the design and conduct of experiments in the research field concerned, data collection, and statistical analysis.

Advanced Nanochemistry

Lectures in this course include, but not limited to, basic concepts of nanochemistry, nanomaterial analysis methods, self-assembly, synthesis and chemical properties of metal nanoparticles, applications of nanoparticles, chemistry of carbon nanomaterials,

bio-inorganic nanomaterials, and hybrid nanocomposites.

Study in Drug Delivery

In this course, students explore the theoretical frameworks of physics, chemistry, and materials science applied to the engineering of drug delivery systems, which are increasingly attracting attention in the contemporary advanced industry, focusing on topics in engineering and medicine, such as polymer chemistry, biomaterials, pharmacokinetics, and transport phenomena in pharmaceutical systems. Delivery routes include transdermal, aerosol, oral, and gene and target cell delivery systems. On a related note, focus is on manufacturing considerations and relevant physiological environment.

Advanced Quantum Chemistry

In this course, the overall system of quantum mechanics is examined, and theoretical explanations of molecular structure and properties, chemical bonds, and chemical reactions are provided based on the related principles, along with presentations of spectroscopic properties and computational approaches using them.

Energy Materials Engineering

This course covers the theories and operating principles of the conversion of renewable energy, such as solar cells, secondary cells, and fuel cells, along with discussions about the actual need for energy devices and related application technologies.

Introduction to Nanoscience and Technology

In this course, students learn nanostructure measurement and control techniques and the changes affecting the characteristics and functions of nanostructures, with the size and composition controlled. Given that nanotechnology can be controlled at the cellular and molecular levels, the possibility of their applications in the fields of healthcare and life sciences is discussed based on the understanding of the phenomenon of life such as cell signaling pathways.

Introduction to Convergence Science and Technology

This course is a core course mandatory for students seeking master's and doctoral degrees at the Graduate School of Convergence Science and Technology. Introductory lectures are given on the academic definition and classification of convergence science and technology and three subfields: nano convergence technology, digital information convergence technology, and intelligent convergence system technology.

Nano Convergence Technology and Environment

This course provides an overview of the applications in the energy and environment

fields based on nanotechnology. The focus of lectures is on the application of nanotechnology in energy conversion, storage and environmental protection tailored to the needs of master's and doctoral students who do not major in chemistry.

Nanobioscience

The focus of lectures in this course is on the principles of molecular interaction of large biomolecules such as DNA and protein, the structure and function of biological membranes, the electron transport system, and the operating principles and molecular mechanisms of various biological signal transducers. In addition, a range of research methodologies used in nano-bioscience are introduced and discussed.

Nano-chemistry and Material Science

In this course, students learn about nanoscale chemical reactions and nanomaterials and methods to synthesize single-component materials and multi-component nanocomposites made of nanoparticles and their physical properties. Also introduced are next-generation devices and processes enabled by nanomaterials and nano-fusion processes, and their impact on the industry as a whole.

Sensing in Bioengineering

Biosensor science studies devices that convert biochemical signals into electrical signals. It is a future-oriented convergence technology that requires expertise embracing all areas science including physics, chemistry, biology, electronic engineering, and materials engineering. With a range of application fields already established, it is a discipline that is currently in the limelight as one of the most promising blue oceans of the 21st century

Photonic Materials and Application

In this course, students learn the physical and optical properties of optoelectronic materials, such as various biomaterials, organic materials, carbon materials, and ceramic materials, along with theoretical principles, which enables them to discuss potential applications of these materials to optoelectronic devices and biophotonic devices.

Advanced Microbiology

The focus of the lectures in this course is on classification of viruses, rickettsia, bacteria, and fungi and their characteristics, and also on the biological characteristics of microbial strains, resistance of pathogens, and sensitivity to antibiotics.

Advanced Molecular Biology

In this course, mechanisms of the phenomenon of life, such as nucleic acids, protein synthesis, regulation of gene expression, and the structure synthesis and properties of

molecular biochemical structures, are discussed at the molecular level.

Advanced Molecular Genetics

In this course, the structure, function, regulation mechanism and phenotype expression are discussed at the molecular level.

Advanced Biotechnology

This course covers gene manipulation and its applications, such as genetic recombination technology, gene injection, and the production, isolation and purification of gene products.

Advanced Biochemistry

In this course, students learn about the chemical understanding of the components of life and the biological metabolism associated with the phenomenon of life.

Advanced Plant Biotechnology

The main focus of this course is on biotechnology-based development of new plant varieties by assessing plant genetic diversity and using molecular breeding and transformation technologies.

Advanced Plant Tissue Culture

In this course, the main focus of the lectures is on the theory and use of tissue culture techniques such as disease-free culture, mutant breeding, embryo culture, and mass production.

Advanced Genetics

In this course, the basic concept of genetic phenomena is solidified and latest topics are selected for in-depth discussion about general issues of genetics.

Directed Research

This course guides students through dissertation writing and is offered to juniors and seniors only.

Research Method

This course introduces the purpose of research and objective research and reporting, and presents important stages of a research project, such as planning and design, as well as convincing solutions of related challenges.

Advanced Cell Biology

The focus of this course is on the structure and function of cells. In particular, the microstructure of cells and their functions are examined under the biochemical and molecular biological aspects. Lectures are given on the molecules constituting cellular matter, the structure and function of organelles, cytogenetic issues, and cell differentiation and interactions.

Advanced Virology

Advanced-level lectures are given in this course, which include, but not limited to, the microscopic structure of viruses, their relationship with host cells, viral pathogenicity, and their relationship with the human body.

Advanced Environmental Biology

Lectures are given on the environment and organisms, the interrelationships between organisms, and the structure and function of ecosystems

Research in Cytogenetics

Students learn about various cytogenetic research methodologies and gain understanding of the latest research fields and research methodologies

Method in Plant science

Lectures are given on basic knowledge and theoretical foundation required for understanding the phenomena of plant life, based on which students can understand the research outcomes achieved in the field of modern plant life science.

Advanced Cytogenetics

Focus of this course is on understanding karyotype based on chromosomes, ploidy, chromosomal aberrations and chromosome abnormality syndromes, cell cycle, DNA synthesis, banding patterns, somatic cell hybridization, and FISH using the latest molecular biological techniques.

Thesis Research I, II

In this course, the whole process of dissertation writing is explained, which includes the design and conduct of experiments in the research field concerned, data collection, and statistical analysis.

Advanced Statistics

Students acquire sufficient knowledge of statistical methods and analysis processes so that they can apply them to their respective research projects.

Advanced Molecular Cytogenetics

Students learn cytogenetic grafting in chromosomal analysis and genome analysis using the state-of-the-art molecular biological techniques.

Advanced Bioinformatics

Lectures are given on the use and application of cutting-edge research achievements in life sciences using computers to collect, manage, synthesize, and analyze data obtained from a vast number of living organisms.

Special Topics in Genomics

This course introduces experimental approaches to studying the structure and function

of genomes to understand the phenomenon of life at the comprehensive level of genomes, not at the level of individual genes, and bioinformatic analysis techniques, along with important research outcomes.

Advanced Botany

Lectures are given on basic knowledge and theoretical foundation required for understanding the phenomena of plant life.

Special Topics in Botany

In this course, students learn to understand the research outcomes in the field of plant science using the basic knowledge plant biology.

Special Topics in Molecular Biology

In this course, students analyze and learn molecular biological techniques to identify the latest research trends and use them for their research projects.

Advanced Genomics

Through lectures on the structure and function of genomes, in which the latest research topics are introduced, students gain understanding of the genes and genetic information of organisms.

Special Topics in Genetics

Based on the basic knowledge of genetics, students discuss the latest research topics and understand the subject matters in the field of genetic research.

Special Topics in Bioinformatics

Lectures are given on the use and application of cutting-edge research achievements in life sciences using computers to collect, manage, synthesize, and analyze data obtained from a vast number of living organisms.

Special Topics in Molecular Cytogenetics

This course covers the latest research achievements on the subject matters of in molecular cytogenetics.

Special Topics in Molecular Genetics

In this course, the structure, function, regulation mechanism and phenotype expression are discussed at the molecular level in great detail using the latest research topics.

Special Topics in Biotechnology

This course covers gene manipulation and its applications, such as genetic recombination technology, gene injection, and the production, isolation and purification of gene products in great detail using the latest research topics.

Special Topics in Biochemistry

In this course, students learn about the chemical understanding of the components of

life and the biological metabolism associated with the phenomenon of life in great detail using the latest research topics.

Special Topics in Tissue Culture

Students learn about the cutting-edge plant tissue culture techniques and related research trends and research techniques.

Advanced Research Method

Students identify trendy research fields and discuss the purpose, method, and main results of the latest studies in the research fields concerned.

Special Topics in Research Method

Students learn how to design and apply experiments using the latest research techniques by understanding advanced research methodologies.

Special Topics in Cell Biology

Students learn and discuss the latest research achievements obtained at the cellular level, and use them for their own research projects by designed design experiments accordingly.

Special Topics in Cytogenetics

Focus of this course is on investigating karyotype based on chromosomes, ploidy, chromosomal aberrations and chromosome abnormality syndromes, cell cycle, DNA synthesis, banding patterns, somatic cell hybridization, and FISH using the latest molecular biological techniques in great depth using the latest research topics.

Introduction to computer

Learn the basics of the basic and theoretical parts of computer science and use cases of computers in various fields.

Secure Coding

Students learn the concept of secure coding, standard coding rules for each language, and secure coding guidelines. In addition, seminars are organized on various techniques for analyzing program vulnerabilities and recent research topics in the field of secure coding

Advanced Web Information Processing

Topics such as Web data path expression, management, query processing, and indexing are covered based on a broad understanding of data processing on the Web.

Advanced Integrated Service Digital Network

ISDN structure and concept, latest technology trends, exchange methods and network configuration, and application services are examined in great detail.

Advanced Databases

The topics dealt with in this course include, but not limited to, understanding of data models, transaction processing, recovery, concurrency control, and query optimization, using relational databases.

Database Security

In this course, students learn about database system security applicable as an essential element to strengthen the security function of information systems. They learn to understand the concept of security in the database system, identify the elements that can violate database system security, and discuss database design methodologies to ensure data security.

Topics in Database Systems

In this course, students discuss the concepts and research trends of advanced techniques for building database systems. In this process they identify the basic elements necessary for developing the engine of a database system and consider techniques that can support a distributed environment. They also discuss research trends related to the topics regarding data mining and data warehousing as well as online transaction.

Advanced Software Engineering

In software development, greater importance is given to the process of software design tailored to user requirements than to coding. When a system developer intends to establish the process of project analysis, design, implementation, and execution, it is important to design software prior to coding, using standardized and easy-to-understand way to facilitate communication with other developers. The mechanism enabling such software design is learned in this course.

Thesis Research I, II

This is a supervisory course to guide student through the process of thesis writing, including technical training and understanding of the research topic, combining individual coaching and group instructions including presentation. Involvement of external professionals in the form of working group or seminar is also considered.

Special Topics in Computer Science

In this course, students present and discuss the latest theories to acquire new knowledge in the computer field.

Compiler Design Theory

The purpose of this course is to create experimental compilers using an automated compiler. To this end, students learn the function and use of automated compiler through lectures focusing on symbol tables, characteristics of intermediate codes, code

optimization, and code generation techniques.

Embedded System

In this course, students acquire basic knowledge of the basic structure and features of embedded system, the need for embedded software with functions, and application fields. They also acquire theoretical knowledge required for professionals and the ability to design and build useful applications in a given environment, implementing them in projects related to the latest issues encountered by the industry in tandem with a sufficient amount of experiments.

Mobile System Programming

Students learn the structure and operating principles of the Android system, which has recently attracted much attention in the mobile field. Technologies necessary for understanding the system, such as JNI, Binder IPC, and AIDL, are presented and the native system services provided by the Android framework is analyzed.

Data Stream Processing

Data stream processing is one of the latest research areas in which research areas such as network, database, and security are converged together. Technologies such as Filter, Index, Approximation, and Load Shedding, which are used for real-time processing of huge amounts of data generated in the network, are presented along with methods for detecting abnormal status on the network, such as DDoS Attack, which has recently aroused much interest.

Internet Protocol

In this course, students learn the basic principles and concepts of the Internet operation, and also the operation principles, concepts, and development direction of major Internet protocols.

Advanced Data Communication Theory

This course covers software and hardware technologies of computational information processing system, data communication network, data transmission technology, and system development.

Advanced Computer Graphics

Students learn the overview and system of Computer Graphics, of basic elements of 2D–3D and geometric transformation, modeling, lighting, rendering, special graphic techniques and animation, and various graphic tools.

Advanced Multimedia Programming

Students learn programming languages necessary for creative and efficient multi-media synthesis and production that compensate for the limitations in the use of multimedia

content creation tools, and topics related to the direction and application of more efficient and upgraded technology development.

Advanced Computer Architecture

The topics covered in this courses include, but no limited to, processor, instruction set, addressing, control structure, input/output, memory system structure analysis, and design methodology for each component of the computer system.

Current Issues in Computer Science

The main focus of this course is the latest research trends and applications in the computer field.

Advanced Operating Systems

The purpose of this class is to implement the Real Time OS on the Computer board available at market. Through out the lass, the students will refresh the knowledge of OS acquired during undergraduate and they will also implement its primitives on the board through coding. During the course they will learn about CPU architecture, context, and its switching and restore, virtual memory, exceptions, MMU and page table setup, and Task control Block. and enhancing the skills of using the required tools such as preprocessor, compiler, assembler, linker, and loader. They all learn and experience these important components for OS implementation through the projects.

Advanced Mobile Application Technology

The main focus of this course is on the latest technology trends according to the ongoing mobile programming development. For mobile program development, Object-C (iPhone) and Java (Google's Android) has been mainly used so far. In terms of development time and cost, Mobile Web&App, a novel mobile program development technique, is advantageous over native apps. While native apps need to be developed for each platform, incurring development time and cost, Mobile Web&App supports cross-platform, enabling mobile program development to be implemented more stably and rapidly, using HTML5, CSS3, and Javascript based on frameworks such as jQuery Mobile and Sencha Touch2. For this reason, this course studies mobile development that reflects the latest technology development trend;

Big Data Processing

In this course, students learn MapReduce technique for big data processing and classic big data processing systems such as Hadoop implemented MapReduce, and discuss various techniques aimed to improve the processing speed in the related system. They also examine examples of applications, such as Google, Twitter, Facebook, and Wal-Mart, and the characteristics of the pilot project introduced by each company.

Machine Learning

In this course, we learn the basics of machine learning, which is the core of modern artificial intelligence. It deals with the theory and methodology that underlies machine learning. Specifically, we learn mathematics for machine learning, basic concepts of machine learning, supervised learning models such as classification and regression, unsupervised learning models such as clustering and dimension reduction techniques, and ensemble models.

Advanced Human Physiology

This course will cover the integration of body systems and many physiological mechanisms that keep the systems working.

Advanced Food Service System Management II

This course is a study of the organization and management of foodservice systems. This course will be taught the management processes, concepts and principles which contribute to the efficiency and effectiveness of the foodservice system.

Special Topics in Functional Food

This course will describe functional foods and nutraceuticals, including their health benefits, physicochemical properties, development, and regulation.

Food, Nutrition and Immunity

This course will cover innate and acquired immunity including cells, tissues and organs in human body. This course will focus all aspects of nutrition for immunity in various disease states such as obesity, diabetes, cancer, etc.

Special Topics in Food Analysis

The course will describe the theory and application of physical and chemical methods for determining the constituents of foods.

Special Topics in Food Analysis Quality Assurance and Safety Evaluation of Food

This course will cover food safety issues related to biological, chemical, and physical hazards, and the importance of risk analysis (risk assessment, risk management, risk communication). How to manage the food safety risk from farm to table will be also discussed.

Advanced Fermentation Technology II

Fermentations occurs when microorganisms consume susceptible organic substrate as part of their own metabolic processes. Today, other methods of food preservation are superior to fermentation. Therefore the major importance of fermented foods has become to provide variety to the diet. This course will be taught microorganisms ferment food constituents, benefits of fermentation and traditional fermented food.

Current Topics in Food and Nutrition

This course will discuss about new topics in food and nutrition fields including new technologies and research trends.

Food Toxicology

This course will cover general principles of toxicological evaluation of hazards which enter the food chain. Toxicological concepts including dose-response relationship, absorption, distribution, and storage of toxicants and their adverse health effects will be also discussed.

Statistics

Understanding the conceptual underpinnings of statistical methods and how to implement the methods using statistical software programs.

Community Food & Nutrition

This course will cover the assessment of nutritional problems in the community, development of nutrition interventions and critical evaluation of the effectiveness of various nutrition intervention programs.

Pathophysiology II

This course focuses physiological changes in various pathological conditions and cover causes, pathologies, symptoms, diagnosis and treatments of specific diseases with nutritional aspects.

Research in Animal Ecology

Animal ecology is associated not only with the struggle for survival, in which animals use resources or avoid predators, but also with behaviors leading to higher breeding success. Accordingly, the main focus of the lectures given in this course is on explaining the competition between individuals for the opportunity for animals to reproduce and pass on their genes to future generations.

Advanced Animal Physiology

The purpose is to grasp and learn the basic concepts of animal physiology through understanding the disease process and treatment principles of animals, and to broadly understand advanced knowledge of biological functions through knowledge of the structure of life.

Animal Phonetics

This course is dedicated to studying the behavior or movement of animals that can be objectively observed or measured. It consists of four major tasks: analysis of causal relationships of behavior, assessment of the survival values of behavior, and examination of ontogeny and phylogeny of behavior.

Research of Animal Behavior

o ensure the protection, conservation, use, and management of animals, it is necessary to understand animal behaviors and study the interactions between animals and environments. In this course, students learn the methods to observe and analyze the value of animal behavior for their survival.

Conservation Biology

In this course, students learn animal-related basic ecological and behavioral theories that can be applied to strategies to safeguard the conservation of biodiversity and conserve biological communities, and the roles that governments and ecologists should play for that purpose.

Social Biology

Social biology is a genetic determinism that posits that human behavior is determined by genes. In this course, students learn about the strategic behaviors of herd animals to pass on their genes to the next generation.

Wildlife Management Techniques

In this course, students acquire basic knowledge of the core concepts of management and protection of natural ecosystems and wildlife habitats, and the theories applicable to habitat creation, management, and young animal support for management and protection of wildlife.

Advanced Behavioral Biology

In this course, students learn to understand animal behavior and the interaction between animals and environment for the protection, conservation, use, and management of wild flora and fauna.

Thesis Research I, II

In this course, presentations are given on recent research trends, research projects, individual special topics, or research topics to be conducted in the last semester, followed by Q&A and thematic discussions on research prospects.

Advanced animal pathology

Animal clinical pathology aims to acquire a technical system such as maintaining the health of animals by identifying the causes, diagnosis, prognosis, and prevention of animal diseases as a whole.

Advanced animal management

It is a study that conducts research on the understanding of pets living with humans and the healthy management of pets. The purpose of this course is to cultivate advanced knowledge about the characteristics, breeding, and health care of companion animals.

Animal assisted therapy

Animal assisted therapy aims to systematize and develop independent theories and treatment techniques to activate animal assisted therapy in academic research and field.

Animal industry and seminar

The purpose of this course is to predict the future direction of the animal industry through marketability research and data analysis related to the animal industry.