

Department of Health and Safety Convergence Science

I. Educational Objectives

The Department of Health and Safety Convergence Science aims to cultivate professionals capable of conducting proactive research to identify environmental hazardous substances and health risk factors and to monitor and prevent disease occurrence. The department comprises four areas of specialization: Radiological and Medical Science, Clinical Laboratory Science, Environmental Health and Safety, and Air Quality Management. The Major in Radiological and Medical Science seeks to educate professionals capable of developing, measuring, and evaluating radiation and radioactive materials for medical and industrial applications. The Major in Clinical Laboratory Science aims to train professionals who can obtain, apply, and scientifically analyze patient information to generate critical data for disease diagnosis and treatment. The Major in Environmental Health and Safety seeks to develop professionals equipped with specialized knowledge to assess the hazards of environmental substances and establish safety measures. The Major in Air Quality Management aims to educate professionals who contribute to the control and reduction of exposure to air pollution, including fine particulate matter (PM), assess its health impacts, and promote the development of sustainable environments. The educational goal of the Department of Health and Safety Convergence Science is to cultivate advanced researchers who will lead the development of modern medicine and environmental health and safety.

II. Academic Fields (Majors)

Major in Radiological and Medical Science

Major in Clinical Laboratory Science

Major in Environmental Health and Safety

Major in Air Quality Management

III. Departmental Regulations

1. Master's Program

- 1) Students shall determine their courses of study under the guidance of their academic advisor and with the approval of the department chair. Of the 24 credits required for the master's degree, at least 15 credits must be earned from courses offered by the Department of Health and Safety Convergence Science.
- 2) Major courses offered by other departments may be recognized as major courses upon approval by both the academic advisor and the department chair.

2. Doctoral Program

- 1) Students shall determine their courses of study under the guidance of their academic advisor and with the approval of the department chair. Of the 30 credits required for the doctoral degree, at least 15 credits must be earned from courses offered by the Department of Health and Safety Convergence Science.
- 2) Major courses offered by other departments may be recognized as major courses upon approval by both the academic advisor and the department chair.

3. Integrated Master's–Doctoral Program

- 1) Students shall determine their courses of study under the guidance of their academic advisor and with the approval of the department chair. Of the 48 credits required for the integrated master's–doctoral degree, at least 24 credits must be earned from courses offered by the Department of Health and Safety Convergence Science.
- 2) All other requirements shall follow those of the doctoral program.

4. Advisor-Designated Courses

Upon admission, students must consult with their academic advisor before the beginning of the semester. The advisor may designate undergraduate courses or, in the case of doctoral students, graduate courses. The designated courses must be approved by both the academic advisor and the department chair, and students are required to complete all courses designated by the advisor.

5. Appointment of Academic Advisors

- 1) Upon admission, a student shall be assigned the most appropriate academic advisor from among the department faculty, taking into consideration the student's preference and subject to the faculty member's consent.
- 2) Academic advisors and co-advisors must satisfy the qualifications set forth in Article 30 of the Graduate School Enforcement Regulations.

6. Comprehensive Examination

- 1) The subjects for the comprehensive examination shall be designated by the academic advisor and approved by the department chair. The required number of examination subjects is as follows:
 - Master's Program: Two major courses
 - Doctoral Program: Four major courses
 - Integrated Master's–Doctoral Program: Four major courses

- 2) Students who fail the comprehensive examination may retake only the failed subject(s) in the following semester.
- 3) Courses selected for the comprehensive examination must be offered by full-time faculty members.

As a transitional measure, these revised regulations shall take effect on September 1, 2025.

7. Eligibility for Thesis Submission

Students who satisfy the requirements of Article 53 or Article 54 of the Graduate School Enforcement Regulations may submit a thesis for degree conferral upon meeting the following condition:

- Doctoral Program and Integrated Master's–Doctoral Program: The student must have published, as the first author affiliated with Korea University, either:
 - at least two papers in SCI/SCIE-indexed international journals; or
 - at least one paper in a journal ranked within the top 10% of the relevant field.

Accepted papers scheduled for publication shall also be recognized.

8. Miscellaneous

1. Matters not specified in these regulations shall be governed by the Graduate School Academic Regulations and the Graduate School Enforcement Regulations.

9. Supplementary Provision

1. For students admitted to the Department of Health and Safety Convergence Science under the BK21 Program who subsequently changed their affiliation to another department or major, any major credits previously earned in this department shall be recognized as major credits of the Department of Health and Safety Convergence Science if the student later changes their affiliation back to this department.

IV. Courses Offered by the Department of Health and Safety Convergence Science

Major in Radiomedical Science

HSL811 Clinical Radiological Science for Diagnosis [3]

This course focuses on advanced radiation-based diagnostic practices used in clinical settings. Topics include diagnostic radiologic imaging, pathology, and sectional anatomy.

HSL812 Image Quality and Exposure Dose [3]

This course emphasizes the evaluation of image quality in radiologic imaging and the associated radiation exposure dose. Particular attention is given to image sharpness, noise characteristics, and Detective Quantum Efficiency (DQE) in digital imaging systems.

HSL813 Diagnostic Radiographic Instrumentation [3]

This course covers the principles and applications of advanced medical imaging equipment, as well as facilities and systems designed to achieve radiation protection objectives.

HSL814 Quality Control for Imaging Equipment [3]

This course examines international standards and testing methods related to quality control during the manufacturing process of medical imaging equipment and routine quality assurance in clinical practice.

HSL815 Clinical Nuclear Medicine [3]

This course focuses on the operation and clinical applications of advanced nuclear medicine imaging systems, including SPECT and PET, with emphasis on clinical case studies.

HSL816 Medical Imaging System [3]

This course explores the physical principles underlying ultrasound imaging, magnetic resonance imaging (MRI), and X-ray imaging, as well as image reconstruction techniques.

HSL511 Cancer Therapy Technique [3]

This course introduces advanced cancer treatment modalities utilizing electric fields, magnetic fields, heat, and radioactive materials, covering their physical principles and clinical applications.

HSL512 Principles of Diagnostic Radiation [3]

This course provides an overview of diagnostic radiology, including imaging theory, image quality, imaging parameters, and the fundamentals of digital imaging.

HSL513 Radiation Impact Assessment [3]

This course examines the biological effects of radiation used in diagnostic radiology, nuclear medicine, and radiation therapy. Topics include internal and external radiation exposure, biological responses to radioisotope administration, mechanisms and progression of radiation effects at molecular, cellular, tissue, and organism levels, radiation injuries, radioprotective and radiosensitizing agents, and experimental methods in radiation biology.

HSL514 Medical Image Information Science [3]

This course introduces image information theory for medical imaging, image file structures, image evaluation methods, image processing techniques, and medical information systems. Topics include digital image file structures, Fourier transform theory, physical image quality metrics such as MTF, NPS, and DQE, image smoothing, edge enhancement, dynamic range compression, and ROC analysis for visual image assessment.

HSL821 Circuits for Signal Detection [3]

This course covers the fundamental principles of preamplifier circuits, signal processing circuits, and data acquisition systems used in signal detection.

HSL822 Applied Digital Circuit [3]

This course provides practical training in the design, construction, and application of digital circuits used for instrumentation and measurement systems.

HSL521 Applied Measurement I [3]

This course presents theoretical foundations and recent developments in radiation measurement, including mathematical principles and methodologies.

HSL522 Applied Measurement II [3]

This advanced course explores physical, engineering, and environmental applications of radiation measurement.

HSL823 Advanced Radiation Measurement [3]

This course provides an in-depth study of advanced radiation measurement techniques, including mathematical derivations and contemporary developments in the field.

HSL524 Monte Carlo Method [3]

This course introduces the fundamental principles and programming techniques of Monte Carlo simulation methods.

HSL531 Principles and Applications of Radiation Detectors I [3]

This course introduces the operating principles of various radiation detectors and the physical concepts required for understanding their performance.

HSL532 Electronic Circuits for Radiation Detectors [3]

This course examines operational amplifiers, preamplifiers, shaping amplifiers, analog-to-digital conversion systems, and their fundamental circuit designs as applied to radiation detectors.

HSL831 Principles and Applications of Radiation Detectors II [3]

This course focuses on the operating principles and underlying physics of semiconductor-based radiation detectors.

HSL832 Fabrication of Semiconductor-Based Radiation Detectors [3]

Students will fabricate semiconductor radiation detectors and evaluate their performance and operational characteristics.

HSL516 Health Science and Advanced Machine Learning: Theories and Applications [3]

This course introduces advanced machine learning models and their applications in health sciences. Students will learn supervised learning, unsupervised learning, deep learning, and reinforcement learning using R and Python.

HSL534 Artificial Intelligence in Medical Imaging [3]

This course examines the principles of deep learning-based medical image analysis and evaluates current applications, future research directions, and limitations of artificial intelligence in medical imaging.

HSL712 Capstone Design II [3]

This course provides students with opportunities to develop creativity and problem-solving skills through self-directed project planning and comprehensive problem-solving experiences in academic and industry-related settings.

Major in Environmental Health and Safety

HSL884 Chemical Substances Management Policy and Risk Assessment [3]

This course provides an understanding of chemical management policies in Korea and introduces risk assessment methodologies used to support regulatory compliance and risk management.

HSL541 Water Pollution and Ecotoxicology [3]

This course develops the ability to assess and diagnose aquatic environments through the study of hazardous pollutants introduced into water systems and their impacts on aquatic ecosystems.

HSL542 Environmental Administration and Law [3]

This course examines public health-related legislation, including the Food Sanitation Act, Infectious Disease Control Act, and Public Health Control Act, as well as the administrative systems required for their implementation.

HSL543 Environmental Health and Safety Seminar I [3]

Students review and discuss recent literature and research trends in environmental health and safety.

HSL544 Principles of Environmental Risk Assessment [3]

This course introduces scientific methods for assessing adverse health effects resulting from exposure to hazardous substances. Students learn qualitative and quantitative approaches for estimating environmental risks to individuals and populations.

HSL842 Environmental Health and Safety Seminar II [3]

This seminar continues the critical review and discussion of current literature and emerging issues in environmental health and safety.

HSL843 Toxicity and Risk Management [3]

This course reviews recent research in toxicology and develops practical skills for applying toxicity-based risk management strategies.

HSL551 Principles of Data Analysis [3]

Designed for graduate students with a background in basic statistics, this course introduces statistical programming and strategies for data generation and analysis in thesis research.

HSL552 Research Methods in Environmental Toxicology [3]

This course examines contemporary research methodologies and toxicity assessment techniques in environmental toxicology.

HSL553 Health and the Global Environment [3]

This course develops competencies in assessing human health impacts associated with climate change, global warming, and related environmental changes.

HSL554 Aerosol Technology [3]

Students learn the physical properties of aerosols, including particle statistics, inertia, diffusion, nucleation, evaporation, condensation, optical properties, and electrical characteristics, and explore their applications in environmental health, occupational health, nanotechnology, environmental chemistry, and drug delivery.

HSL555 Advanced Environmental Health and Safety I [3]

This course introduces the comprehensive concepts of environmental health and safety and examines the effects of biological, chemical, physical, and environmental hazards on human health.

HSL851 Advanced Environmental Chemistry [3]

Students develop the ability to analyze and evaluate risks associated with chemical substances in living environments through systematic study of environmental chemistry principles.

HSL852 Environmental Ecology and Life Cycle Assessment [3]

This course explores ecosystem formation and ecological processes, with emphasis on advanced environmental evaluation methods including Life Cycle Assessment (LCA).

HSL854 Atmospheric Science [3]

This course introduces the fundamental principles of indoor and outdoor air pollution, including pollutant sources, atmospheric processes, and health effects.

HSL561 Environmental Health Toxicology [3]

Students learn the mechanisms of action and analytical methods associated with environmental chemicals and pharmaceuticals and their applications in environmental health.

HSL563 Environmental Analysis Methods and Exposure Assessment [3]

This course examines analytical methods for environmental hazards and methodologies for assessing their impacts on communities and occupational settings.

HSL562 Environmental Health Techniques for Indoor Air Quality [3]

This course develops competencies in designing effective control strategies and management systems for indoor environmental health issues.

HSL565 Research Methods in Environmental Health and Safety I [3]

This course provides advanced instruction in research design, proposal development, data analysis, and interpretation in environmental health and safety research.

HSL861 Advanced Water Management [3]

This course focuses on water treatment technologies and water quality standards to minimize health risks associated with drinking water and ensure safe water resources.

HSL862 Research Methods in Environmental Health and Safety II [3]

This course provides advanced research methodology training with emphasis on proposal writing, data analysis, and interpretation tailored to individual research projects.

HSL863 Occupational and Environmental Hazards Management [3]

Students learn methods for identifying, controlling, and managing occupational and environmental hazards through comparative analysis of internationally recognized management approaches.

HSL864 Life Environment [3]

This course examines the development of indicators and management strategies for evaluating and controlling pollutants in indoor living environments.

HSL866 Advanced Industrial Health [3]

This course explores strategies for minimizing occupational risks and creating safe work environments through case studies and research presentations.

HSL868 Occupational Ergonomics [3]

Students study ergonomic principles relating worker capabilities to workplace conditions, including work physiology, musculoskeletal disorders, workplace design, equipment design, and ergonomics in manufacturing processes.

HSL872 Safety and Toxicity Assessment [3]

This course examines biological hazards associated with environmental pollutants and pharmaceuticals and introduces methods for evaluating their safety and toxicity.

HSL572 Environmental Health Risk Assessment [3]

Students learn hazard and risk assessment methodologies used in environmental health for the management of chemical substances.

HSL871 Environmental Epidemiology: Study Design and Methodological Issues [3]

This course examines common sources of error in epidemiological research and methods for reducing bias while designing studies appropriate for testing research hypotheses.

HSL571 Environmental Health and Energy [3]

This course explores the relationship between environmental health and energy use, seeking sustainable solutions that balance ecological and public health considerations.

HSL574 Hazardous Chemical Management [3]

Students learn domestic and international regulatory frameworks, hazard assessment methods, risk-ranking approaches, and management strategies for hazardous chemicals.

HSL576 Advanced Environmental Health and Safety II [3]

This course further explores environmental health concepts and the impacts of biological, chemical, and physical environmental hazards on human health.

HSL547 Introduction to Environmental Health Technology [3]

This course introduces research methodologies, instrumental analysis techniques, and emerging technologies used in environmental health convergence research.

Major in Clinical Laboratory Science

HSL611 Special Topics in Clinical Chemistry [3]

This course introduces new instruments, analytical methods, and clinically relevant biomarkers currently utilized in clinical chemistry testing.

HSL612 Special Topics in Hematology [3]

This course provides an in-depth study of the fundamental principles of hematology, including hematopoiesis, red blood cell disorders, white blood cell disorders, coagulation, and hemostasis.

HSL613 Special Topics in Environmental Microbiology [3]

This course covers the classification, morphology, physiology, genetic structure, gene expression regulation, and genetic characteristics of environmentally significant microorganisms.

HSL614 Special Topics in Clinical Biochemistry [3]

This course examines pathophysiological phenomena associated with human organs from a biochemical perspective and explores modern analytical methods and their clinical significance.

HSL615 Molecular Diagnostics [3]

This course provides advanced study of diagnostic testing methods based on biochemistry and molecular biology through the review and discussion of scientific literature.

HSL616 Seminar in Clinical Laboratory Science [3]

This seminar examines recent research trends and developments in clinical laboratory science through critical review of current scientific literature.

HSL617 Applied Laboratory Science [3]

This course discusses how laboratory data are used in relation to patient symptoms and differential diagnosis through case-based learning. Current risk factor guidelines, emerging laboratory tests, and new diagnostic algorithms are also examined.

HSL618 Special Topics in Clinical Physiology [3]

This course provides lectures and discussions on diagnostic procedures used in clinical physiology, including electrocardiography, electroencephalography, and pulmonary function testing.

HSL619 Research and Application of Clinical Laboratory Medicine [3]

This course introduces and discusses significant research topics, methodologies, and applications in clinical chemistry, including urinalysis and immunoassays, as well as hematology.

HSL911 Biomedical Research Methodology [3]

This course develops competencies in biomedical research by covering research design, experimental methods, data analysis techniques, and the interpretation and evaluation of research findings in medicine and health sciences.

HSL912 Special Topics in Advanced Clinical Hematology [3]

This course discusses hematopoietic stem cell biology and its applications in the diagnosis and treatment of hematologic diseases.

HSL913 Advanced Immunology [3]

Through the analysis of recent scientific literature, this course provides an in-depth examination of current research trends and advances in immunology.

HSL914 Special Topics in Biochemistry [3]

This course explores research and methodologies related to genomics, proteomics, and other fields that contribute to understanding the molecular basis of specific diseases and identifying therapeutic targets. Their clinical applications and emerging trends are also discussed.

HSL915 Flow Cytometry [3]

This course covers the principles, applications, and interpretation of flow cytometry for the diagnosis of hematologic disorders.

HSL916 Stem Cell Biology [3]

This course introduces cell development, differentiation and regulation, embryonic and adult stem cells, cell culture techniques, cytokines and signal transduction pathways, and cell-based therapies.

HSL917 Special Topics in Laboratory Science [3]

This course provides advanced study of diagnostic laboratory tests used in clinical practice through literature review and discussion.

HSL918 Special Topics in Infection Control [3]

This course examines the pathogenesis of infectious diseases caused by microorganisms and discusses infection control practices in healthcare settings.

HSL919 Special Topics in Vaccinology [3]

This course discusses vaccine production techniques, immunological approaches for improving vaccine efficacy, and recent research trends in vaccine development through literature-based study.

HSL921 Natural Products and Clinical Chemistry [3]

This course introduces methods for analyzing and purifying bioactive compounds produced during the purification and fermentation of natural products and examines their clinical applications in disease diagnosis and treatment.

Major in Air Quality Management

HSL710 Air Pollution Measurement [3]

This course provides practical training in the measurement and evaluation of major air pollutants associated with current air quality issues. Representative pollutants are selected, and students conduct hands-on monitoring and assessment exercises.

HSL711 Capstone Design I [3]

This course provides students with opportunities to develop creativity and problem-solving skills through self-directed project planning and comprehensive problem-solving experiences in academic and industry-related settings.

Supplementary Provision (June 7, 2017)

These regulations shall take effect on June 7, 2017. (Revision of Article 7 of the Academic Regulations)

Supplementary Provision (December 30, 2020)

These revised regulations shall apply to students admitted beginning in the first semester of the 2021 academic year and shall be applied retroactively to currently enrolled students.