Department of Urban and Environmental Engineering

□ Urban and Environmental Engineering [UEE]

Environmental pollution and climate change caused by industrialization and urbanization are directly related to the survival of human society. With no surprise, studies on these issues are gaining in importance. Urban and environmental engineering is an interdisciplinary research field focusing on environmental protection and sustainable urban development with ultimately aiming toward the improvement of human welfare. In this department, students will study advanced courses represented by three programs:

1) Environmental Science and Engineering (ESE)

The program is an inter-disciplinary major to understand the environmental issues on global and regional scales including climate change. Enrolled students research the science- and engineering-based methodologies to reconstruct the past, monitor the present, and predict the future of the Earth system on various temporal and spatial scales, based on the integrated knowledge of atmospheric, oceanic, and earth sciences. The program also aims to develop state-of-the-art engineering technologies to achieve those scientific goals.

2) Urban Infrastructure Engineering (UIE)

The program contributes to developing smart green cities on our planet's future, through consistent research on principles essential to create the built environment desired for fertile human life and on never-ending problems confronted during the process. It includes interdisciplinary pursues in the field of civil engineering and urban planning.

3) Disaster Management Engineering (DME)

The DME program pursues interdisciplinary education and research in collaboration with researchers in urban/civil engineering, environmental engineering, earth/environmental science, and disaster management to mitigate the impact of unexpected disasters. It focuses on natural hazard prediction, sustainable and resilient infrastructure, disaster risk reduction/prevention, disaster mitigation and preparedness, disaster response and recovery, and disaster risk management policy. This program

also provides educational opportunities for the next generation of disaster researchers and professionals.

4) Convergence of Science and Arts (CSA)

Idea of Education Major 'Convergence of Science and Arts' emerges from questions on definition of science, based on our experiences with single research tool and other convergence studies. Those studies share similarity in methodology procedures towards final conceptual knowledge, including observation, analysis, synthesis, and concept making. With this being in mind, problems and issues with which we are facing now can be observed as either object or subject, represented as some images followed by analysis, and integrated into a conceptual knowledge, with helps of causality and contingency with occurrence probability, which employs scientific and/or liberal arts methodologies. There might be controversy whether liberal arts can be categorized into science, but, may share methodologies to some extents with science, especially procedures prior to final conceptual knowledge making. Integrating and converging science desires to work with liberal arts as there are similarities as well as identity-based differences in methods and products to be made. For example, with regard to water/energy problems and issues under climate change era, it is almost impossible to extract strong concepts and/or knowledge, from isolated scientific division, as almost all the problems and issues are associated directly or indirectly with variables of human being, especially under social system. Without comments of liberal arts, it is not easy to lead to a strong and clear knowledge with problems and issues of many different problems as most of those are connected to human through public perception, policy, regulation, ethics, morality, culture, and many other variables. With these, the education major is launched.

Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 60 credits	at least 18 credits	at least 42 credits
Combined Master's-Doctoral Program	at least 60 credits	at least 36 credits	at least 24 credits

Curriculum

▶ Urban and Environmental Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre requisite	Convergence
Required	UEE690	Research	Master's Research	석사논문연구	Value of Credit		X
	UEE890		Doctoral Research	박사논문연구	Value of Credit		X
	CSA511 /AHS111	Lecture	Understanding Arts*	예술의 이해*	3-3-0		O
	CSA521		Scientific Methodology*	과학기술방법론*	3-3-0		O
Elective	ENV590	Research	The Seminars	세미나	1-1-0		X
	ENV501	Lecture	Advanced Environmental Engineering	환경공학특론	3-3-0		X
	ENV503		Environmental Organic Chemistry	환경유기화학	3-3-0		X
	ENV505		Wastewater Microbiology	폐수미생물학	3-3-0		X
	ENV506		Waste Management	폐기물관리	3-3-0		X
	ENV601		Wastewater Treatment and Process Design	수처리공정설계	3-3-0		X
	ENV604		Aquatic Chemistry	수질화학	3-3-0		X
	ENV605		Chemistry for Environmental Engineering and Science	환경화학개론	3-3-0		X
	ENV607		Environmental Colloid Surface Chemistry	환경콜로이드표면화학	3-3-0		X
	ENV608		Bioprocess Modeling and Control	생물공정모델링 및 공정제어	3-3-0		X
	ENV701		Environmental Photochemistry	환경광화학	3-3-0		X
	ENV702		Environmental Nanotechnology	환경나노기술	3-3-0		O
	ENV703		Introduction to Advanced Oxidation Technology	고도산화기술개론	3-3-0		X
	ENV704		Physical and Chemical Treatment Processes	물리화학적 수처리 공정 특론	3-3-0		O
	ENV705		Movement and Fate of Organic Contaminants in Water	수계 유기오염물질 거동	3-3-0		X
	ENV706		Introduction to Membrane Technology to Water/Wastewater Treatment	수처리/폐수처리 분리막 개론	3-3-0		X
	ENV707		Environmental Biotechnology	환경생명공학기술	3-3-0		X
	ENV802		Special Topics for Environmental Engineers I	환경문제특수해석 I	3-3-0		X

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre requisite	Convergence
Elective	ENV803	Lecture	Special Topics for Environmental Engineers II	환경문제특수해석 II	3-3-0		X
	ENV804		Biosensors	바이오센서	3-3-0		X
	ENV805		Special Topics for Environmental Engineers III	환경문제특수해석 III	3-3-0		X
	ENV806		Special Topics for Environmental Engineers IV	환경문제특수해석 IV	3-3-0		X
	ENV807		Special Topics for Environmental Engineers V	환경문제특수해석 V	3-3-0		X
	ENV808		Special Topics for Environmental Engineers	환경과학공학 특론	3-3-0		O
	EES590	Research	The Seminars1	세미나1	1-1-0		X
	EES591		The Seminars2	세미나2	1-1-0		X
	EES501	Lecture	Technical Writing and presentation skills for environmental scientists	환경과학자를 위한 글쓰기와 프레젠테이션 기술	3-3-0		X
	EES502		Introduction to Environmental Analysis	환경분석개론	3-3-0	CHE103 NCS201 ESE201	X
	EES503		Advanced Atmospheric Dynamics I	고급대기역학 I	3-3-0		X
	EES504		Mass Spectrometry	질량분석학	3-3-0	NCS201	X
	EES505		Tropical Meteorology	열대기상학	3-3-0		X
	EES601		Atmospheric Physics	대기물리	3-3-0		X
	EES602		Gas Hydrates and Climate Change	가스 하이드레이트와 기후변화	3-3-0		O
	EES603		Advanced Atmospheric Dynamics II	고급대기역학 II	3-3-0		X
	EES604		Analysis and Monitoring of Organic Pollutants	유기오염물질 분석 및 모니터링	3-3-0	CHE103 , NCS201	X
	EES605		Air Pollution Management	대기오염관리	3-3-0		X
	EES651		Remote Sensing of the Environment	환경원격탐사	3-3-0	ESE305	O
	EES701		Climate-Environment Modeling	기후환경 모델링	3-3-0		X
	EES801		Special Course on Climate Change	기후변화 특강	3-3-0		X
	EES803		Current Topics in Carbon Dioxide Capture and Storage	이산화탄소 회수 및 저장 특론	3-3-0		X
	EES810		Special Topics in Earth and Environmental Sciences I	지구환경과학 특강 I	3-3-0		X
	EES811		Special Topics in Earth and Environmental Sciences II	지구환경과학 특강 II	3-3-0		X

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre requisite	Convergence
Elective	EES812	Lecture	Special Topics in Earth and Environmental Sciences III	지구환경과학 특강 III	3-3-0		X
	EES813		Special Topics in Earth and Environmental Sciences IV	지구환경과학 특강 IV	3-3-0		X
	EES814		Special Topics in Earth and Environmental Sciences V	지구환경과학 특강 V	3-3-0		X
	EES851		Advanced Modeling Techniques for GIScience Applications	GIScience 응용을 위한 고급 모델링 기법	3-3-0	ESE305	X
	UIE590	Research	Seminar	세미나	1-1-0		X
	UIE501	Lecture	Continuum Mechanics	연속체역학	3-3-0		X
	UIE502		Structural Dynamics	구조동역학	3-3-0		X
	UIE503		Earthquake Resistant Design	내진설계론	3-3-0		O
	UIE504		Low-carbon Concrete	저탄소 콘크리트 공학	3-3-0		X
	UIE505		Research Methods for Urban Studies	도시연구방법론	3-3-0		X
	UIE506		Urban form and spatial structure	도시형태 및 공간구조	3-3-0		X
	UIE507		Finite Element Method	유한요소법	3-3-0		X
	UIE509		Urban Design Workshop	도시설계워크샵	3-3-0		X
	UIE510		Advanced Engineering Mathematics	고급공학수학	3-3-0		X
	UIE601		Prestressed Concrete	프리스트레스트 콘크리트	3-3-0		X
	UIE602		Crack Analysis in Concrete	콘크리트 균열해석	3-3-0		X
	UIE603		Time-Dependent Properties of Concrete	콘크리트 시간의존적 특성	3-3-0		X
	UIE605		Real Estate Development and Investment	부동산 개발 및 투자	3-3-0		X
	UIE701		Stability of Structures	구조안정론	3-3-0		O
	UIE702		Nonlinear Finite Element Analysis	비선형 유한요소해석	3-3-0		X
	UIE704		Concrete Micro-characterization	콘크리트 미세구조분석	3-1-4		X
	UIE706		Urban Regeneration	도시재생	3-3-0		X
	UIE707		Theory of Planning	계획이론	3-3-0		X
	UIE708		Planning for Housing	도시주택론	3-3-0		X
	UIE802		Rheology of Concrete	콘크리트 레올로지	3-2-2		X
	UIE804		Urban Modeling and Simulation	도시 시뮬레이션	3-3-0		X

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre requisite	Convergence
Elective	UIE810	Lecture	Special Topics in Urban Infrastructure Engineering Ⅰ	도시기반시설공학특론 Ⅰ	3-3-0		X
	UIE811		Special Topics in Urban Infrastructure Engineering Ⅱ	도시기반시설공학특론 Ⅱ	3-3-0		X
	UIE812		Special Topics in Urban Infrastructure Engineering Ⅲ	도시기반시설공학특론 Ⅲ	3-3-0		X
	UIE813		Special Topics in Urban Infrastructure Engineering Ⅳ	도시기반시설공학특론 Ⅳ	3-3-0		X
	UIE814		Special Topics in Urban Infrastructure Engineering Ⅴ	도시기반시설공학특론 Ⅴ	3-3-0		X
	DME590	Research	Seminar	세미나	1-1-0		X
	DME502	Lecture	Structural Reliability	구조신뢰성	3-3-0	DME311	O
	DME503		Disaster Response and Recovery	재난대응 및 복구	3-3-0		X
	DME504		Surface Hydrology	지표수문학	3-3-0	ESE332	X
	DME505		Disaster Mitigation and Preparedness	재난완화 및 대비	3-3-0		X
	DME506		Numerical Weather Prediction	수치 예보	3-3-0		O
	DME507		Climate and Air Pollution : Integrated Approach	기후와 대기환경 : 통합적 접근	3-3-0		X
	DME508		Introduction to Safety Design	안전디자인 개론	3-3-0		X
	DME509		Geotechnical Earthquake Engineering	지반지진공학	3-3-0		X
	DME601		Disaster Planning and Policy	재난계획 및 정책	3-3-0		O
	DME602		Earthquake Engineering	지진공학	3-3-0	UIE502	X
	DME603		Wind Engineering	풍공학	3-3-0	UIE502	X
	DME604		Reliability of Infrastructure Systems	사회기반시설시스템의 신뢰성	3-3-0	DME502	X
	DME701		Disaster Theory and Practice	재난이론과 응용	3-3-0		X
	DME702		Advanced Numerical Modeling for Weather	고급기상수치모델링	3-3-0	DME421	X
	DME703		Random Vibrations	불규칙진동론	3-3-0	UIE502	X
	DME704		Smart Structures	스마트구조	3-2-2	UIE502	X
	DME705		Micro-meteorology and Environment	환경미기상학	3-3-0		X
	DME801		Special Topics in Disaster Management Engineering Ⅰ	재난관리공학특론 Ⅰ	3-3-0		X
	DME802		Special Topics in Disaster Management Engineering Ⅱ	재난관리공학특론 Ⅱ	3-3-0		X
	DME803		Special Topics in Disaster Management Engineering Ⅲ	재난관리공학특론 Ⅲ	3-3-0		X

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre requisite	Convergence
Elective	DME804	Lecture	Special Topics in Disaster Management Engineering IV	재난관리공학특론 IV	3-3-0		X
	DME805		Special Topics in Disaster Management Engineering V	재난관리공학특론 V	3-3-0		X
	CSA501		Introduction to Convergence Environmental Technologies	융합환경기술개론	3-3-0		O
	CSA561 /AHS161		Introduction to Philosophy	철학개론	3-3-0		O
	CSA590	Research	Convergence in Science and Arts Seminars I	과학예술융합 세미나 I	1-1-0		O
	CSA591		Convergence in Science and Arts Seminars II	과학예술융합 세미나 II	1-1-0		O
	CSA611 /AHS211	Lecture	Design Thinking	디자인 씽킹	3-3-0		O
	CSA661 /AHS261		Contemporary Philosophy	현대철학	3-3-0		O
	CSA710 /AHS310		Topics in Arts	예술특강	3-3-0		O
	CSA711		Special Topics in Science and Arts I	과학예술특론 I	3-1-4		O
	CSA712		Special Topics in Science and Arts II	과학예술특론 II	3-1-4		O
	CSA713		Special Topics in Science and Arts III	과학예술특론 III	3-1-4		O
	CSA714		Special Topics in Science and Arts IV	과학예술특론 IV	3-1-4		O
	CSA715		Special Topics in Science and Arts V	과학예술특론 V	3-1-4		O
	CSA716		Special Topics in Science and Arts VI	과학예술특론 VI	3-1-4		O
	CSA717		Special Topics in Science and Arts VII	과학예술특론 VII	3-1-4		O
	CSA718		Special Topics in Science and Arts VIII	과학예술특론 VIII	3-1-4		O
	CSA719		Special Topics in Science and Arts IX	과학예술특론 IX	3-1-4		O
	CSA720		Special Topics in Science and Arts X	과학예술특론 X	3-1-4		O
	CSA760 /AHS360		Topics in Philosophy	철학특강	3-3-0		O

* Those related to Environmental Science in ESE program and enrolled in 2013 should take the seminars1(EES590) and the seminars2(EES591).
* Understanding Arts(CSA511/AHS111), and Scientific Methodology(CSA521) are required only for students who are majoring CSA.

Description

UEE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

UEE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ENV501 Advanced Environmental Engineering [환경공학특론]

For graduate students whose major was not environmental engineering, the history of environmental engineering and major disciplines will be introduced.

ENV503 Environmental Organic Chemistry [환경유기화학]

This course focuses on environmental factors that determine the fate of organic chemicals in natural and engineered systems. The knowledge learned from this course is useful to quantitatively assessing the environmental behaviour of organic chemicals.

ENV505 Wastewater Microbiology [폐수미생물학]

The goal of this course is to gain a fundamental understanding of microorganisms and their roles in wastewater environments.

ENV506 Waste Management [폐기물관리]

This course will introduce waste classification, physico-chemical properties, instrumental analysis, waste source, collection and recycling, remediation and treatment and life cycle assessments (LCA).

ENV601 Wastewater Treatment and Process Design [수처리공정설계]

The purpose of this course is to study basic principles of chemical, physical and biological treatment facilities and to design the unit operations and processes of water and wastewater treatment.

ENV604 Aquatic Chemistry [수질화학]

Basic concepts and chemical principles of water chemistry will be introduced, emphasizing the application of the principles to solve the specific chemical problems in aqueous environment, pollution control and purification technology.

ENV605 Chemistry for Environmental Engineering and Science [환경화학개론]

The purpose of this course is to bring into focus some aspects of chemistry which are valuable for solving environmental problems and lay a background of understanding in the area of specialized quantitative analysis, commonly referred to as water and wastewater analysis.

ENV607 Environmental Colloid Surface Chemistry [환경콜로이드표면화학]

This course covers two major areas: (1) various surface chemistry areas including hydrous oxide-water interface, electric double layer theory, adsorption mechanisms, and particle-particle interaction, (2) colloid hydrodynamics including basic motion equations, motion of single and two interacting colloids in water.

ENV608 Bioprocess Modeling and Control [생물공정모델링 및 공정제어]

This course aims to provide students with fundamental knowledge of bioprocess operation and control with particular emphasis on environmental treatment systems. Different biokinetic models and their applications in process control are discussed.

ENV701 Environmental Photochemistry [환경광화학]

The objective of this course is to understand the basic concepts and principles of photochemistry and to gain insight into its implication in environment and the applications in environmental technologies.

ENV702 Environmental Nanotechnology [환경나노기술]

This course introduces the recent research trends about environmental nanotechnologies and also covers the environmental impact of engineered nanoparticles.

ENV703 Introduction to Advanced Oxidation Technology [고도산화기술개론]

This course provides basic concepts and principles of advanced oxidation technologies for environmental remediation which include ozonation, Fenton systems and photocatalytic processes.

ENV704 Physical and Chemical Treatment Processes [물리화학적 수처리 공정 특론]

This course introduce the fundamentals of physical/chemical treatment processes and will help students learn how to design the processes.

ENV705 Movement and Fate of Organic Contaminants in Water [수계 유기오염물질 거동]

This course covers basic principles on the transport of organic chemicals in surface waters and ground-waters. including their sorption, mass transfer, advection, dispersion, etc.

ENV706 Introduction to Membrane Technology to Water/Wastewater Treatment [수처리/폐수처리 분리막 개론]

Fundamental principles of membrane technology with focus on microfiltration, ultrafiltration, nanofiltration and reverse osmosis. Emphasis is on polymer chemistry, synthesis, modification, characterization and degradation of membranes and then application of the membranes to solve problems in aquatic systems.

ENV707 Environmental Biotechnology [환경생명공학기술]

This course introduces applications of biotechnologies and molecular techniques today in environmental engineering with particular emphasis on biological pollutant removal processes.

ENV802 Special Topics for Environmental Engineers Ⅰ[환경문제특수해석 Ⅰ]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV803 Special Topics for Environmental Engineers II [환경문제특수해석 II]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV804 Biosensors [바이오센서]

Biosensors are tools utilizing at least one biological component, such as DNA, RNA, protein, whole cell, etc., which is used to detect and report on the presence of specific chemicals or groups of chemicals. As such, this class will cover topics related with biosenors, including their classes, development, fabrication, validation and current use in a variety of applications, especially in toxicity sensing.

ENV805 Special Topics for Environmental Engineers III [환경문제특수해석 III]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV806 Special Topics for Environmental Engineers IV [환경문제특수해석 IV]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV807 Special Topics for Environmental Engineers V [환경문제특수해석 V]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV808 Special Topics in Environmental Science and Engineering [환경과학공학 특론]

This course covers interdisciplinary topics on environmental science and engineering including environmental pollution and control, environmental analysis, climate change, and earth science.

ENV590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

EES501 Technical writing and presentation skills for environmental scientists [환경과학자를 위한 글쓰기와 프레젠테이션 기술]

This course will address practical methods for technical writing (journal articles) and presentation. Students learn more efficient and successful ways to prepare their own manuscript to be submitted to an international refereed journal.

EES502 Introduction to environmental analysis [환경분석개론]

This course introduces sampling, pretreatment, and instrumental analysis for organic pollutants and heavy metals. The main contents are transport of pollutants, water analysis (major and trace constituents), analysis of solids and waste, atmospheric analysis (gases and particulates), and ultra-trace analysis.

EES503 Advanced Atmospheric Dynamics I [고급대기역학 I]

The course covers fundamentals of geophysical fluid dynamics, which consists of five small topics. We first provide a brief introduction to fluid dynamics and the basic equations of motion. Then, the effects of stratification and rotation is introduced to discuss fundamental topics such as the primitive equations and the Boussinesq equations. Also, we introduce the shallow water equations that forms the simplest expression of many of the principles of geophysical fluid dynamics. We then discuss vorticity and potential vorticity. Finally, we derive simplified equation sets for large-scale flows, e.g. the quasi-geostrophic equations.

EES504 Mass Spectrometry [질량분석학]

This course will introduce the principle and types of mass spectrometry, which has been widely used for trace-level analysis of organic pollutants. The interpretation of mass spectrum and applications for dioxin analysis will be also introduced.

EES505 Tropical Meteorology [열대기상학]

Atmospheric motion in the tropics is distinguished from that in extratropics in physical and dynamical aspects. The content includes the observed characteristics of tropical atmosphere, characteristics of tropical dynamics, tropical waves, and thermodynamic aspects of tropical atmosphere. The lecture is followed by tropical phenomena of El Nino-Southern Oscillation, Intraseasonal Oscillation, Monsoon, and Tropical Cyclone. This course is intended for early graduate or undergraduate students.

EES601 Atmospheric Physics [대기물리]

Atmospheric physics is applied to study the details of weather and climate, which includes the processes of radiation, cloud physics, convection, and turbulence. Moreover, understanding of the interaction between aerosol and cloud microphysics is gaining its importance recently for its uncertain role in the global warming. The course will cover these processes and their theoretical backgrounds based upon physics.

EES602 Gas Hydrates and Climate Change [가스 하이드레이트와 기후변화]

This course presents the basic understanding and concepts of gas hydrates and their impacts on climate change. This course also covers exploration and production of natural gas hydrates, gas hydrate-based carbon dioxide capture and storage methods, and other novel technologies relating to gas hydrates.

EES603 Advanced Atmospheric Dynamics II [고급대기역학 II]

The course is composed of two main topics: i) instabilities and wave-mean flow interaction, ii) large-scale atmospheric circulation. In the first half, we cover barotropic and baroclinic instability and how the waves and instabilities affect the mean flow in which they propagate. In the second half, we are mostly concerned with the dynamics of the Hadley and Ferrel Cells and mid-latitude circulation.

EES604 Analysis and Monitoring of Organic Pollutants [유기오염물질 분석 및 모니터링]

This course will focus on multimedia sampling, extraction, cleanup and instrumental analysis for environmental monitoring of organic pollutants.

EES605 Air Pollution Management [대기오염관리]

This course presents information about the general topic of air pollution and its control, and also covers the design procedures of various air pollution control.

EES651 Remote Sensing of the Environment [환경원격탐사]

This course investigates diverse applications of remote sensing as well as advanced digital image processing techniques for each application. This course covers understanding of various remote sensing systems (e.g. hyperspectral, LiDAR), their applications (e.g. vegetation, water) and advanced digital image processing techniques (e.g. object-based, texture-based, machine learning). Several interactive digital image processing systems (e.g., ENVI, ERDAS IMAGINE, ArcGIS, and/or MATLAB) are used by the students to analyze satellite and airborne-acquired remotely sensed image data.

EES701 Climate-Environment Modeling [기후환경 모델링]

The global climate model has been extensively used for medium-range weather forecasts, seasonal prediction, global atmospheric and oceanic reanalyses, and climate change predictions due to the increased greenhouse gases. This course introduces state-of-the-art modeling technologies that construct the model, including numerical approximations for the dynamical part, and the representations of physical parts related with sub-grid scale radiation, condensation, boundary-layer turbulence, and the treatments of land surface. The students will experiment and produce the actual simulation outputs by testing the community model opened in public.

EES801 Special Course on Climate Change [기후변화 특강]

This is a special course designed for motivating and fostering creative and interdisciplinary research models targeting on climate change. For a comprehensive understanding on the climate change, the

class will review important highlights from the recent assessment reports from the Intergovernmental Panel on Climate Change (IPCC). The class will be asked to develop their own research projects during the course.

EES803 Current Topics in Carbon Dioxide Capture and Storage [이산화탄소 회수 및 저장 특론]

This course is intended to introduce recent technologies on carbon dioxide capture and storage developed and being developed for mitigating global warming.

EES810 Special Topics in Earth and Environmental Sciences Ⅰ [지구환경과학 특강 Ⅰ]

We study the current hot topics in Earth and Environmental Sciences.

EES811 Special Topics in Earth and Environmental Sciences Ⅱ [지구환경과학 특강 Ⅱ]

We study the current hot topics in Earth and Environmental Sciences.

EES812 Special Topics in Earth and Environmental Sciences Ⅲ [지구환경과학 특강 Ⅲ]

We study the current hot topics in Earth and Environmental Sciences.

EES813 Special Topics in Earth and Environmental Sciences Ⅳ [지구환경과학 특강 Ⅳ]

We study the current hot topics in Earth and Environmental Sciences.

EES814 Special Topics in Earth and Environmental Sciences Ⅴ [지구환경과학 특강 Ⅴ]

We study the current hot topics in Earth and Environmental Sciences.

EES851 Advanced Modeling Techniques for GIScience Applications GIScience [응용을 위한 고급 모델링 기법]

This course introduces advanced modeling techniques that have recently been used in GIScience applications. The techniques include machine learning approaches for both classification and regression such as decision/regression trees, random forest, support vector machines/regression, artificial neural networks, artificial immune networks, and genetic algorithms. The students will analyze GIScience data using several interactive software tools (e.g., MATLAB, ArcGIS, LP360, and ERDAS Imagine).

EES590 The Seminars1 [세미나1]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

EES591 The Seminars2 [세미나2]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields

and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

UIE501 Continuum Mechanics [연속체역학]

This course is concerned with idealization of continuous materials that can be a solid or a fluid. In lectures, we deal with tensor expression, definition of stress and strain in 3 dimensional space, and developing constitutive equations.

UIE502 Structural Dynamics [구조동역학]

The dynamic response of structures and structural components to transient loads and ground excitations is discussed for single and multi degree-of-freedom systems, including discussions for response spectrum concepts, simple inelastic structural systems, systems with distributed mass and flexibility, and fundamentals of experimental structural dynamics.

UIE503 Earthquake Resistant Design [내진설계론]

The course topics include the behavior, design, and assessment of indeterminate reinforced concrete and steel structures subjected to gravity, wind, seismic, and blast loads. Primary emphasis will be given to the introduction of available design methods for two-way slab systems, and the earthquake-resistant design of beam-column frames, slab-column frames, and shear walls.

UIE504 Low Carbon Concrete [저탄소 콘크리트 공학]

Portland cement concrete is highly economical and versatile construction building material; however, manufacture of portland cement is responsible for at least 5~8% of total worldwide man-made CO2 emission because one ton of portland cement production generates 0.9 ton of CO2. Development of new alternative binder with extremely low carbon emission to replace the portland cement in concrete production has been an urgent goal in academia and industries to build up sustainable future urban society. This course presents the state-of-art technology and research methodologies in the low carbon concrete.

UIE505 Research Methods for Urban Studies [도시연구방법론]

Quantitative analysis of data used in urban planning research. Particular emphasis on Inferential statistics through multinomial regressions, forecasting, categorical data analysis, and spatial data analysis.

UIE506 Urban form and spatial structure [도시형태 및 공간구조]

This course is about the analysis of urban form, pattern, and process. Historical exploration of how cities are patterned empirical evidence of the contemporary spatial development of metropolitan areas Industrial, residential and commercial location.

UIE507 Finite Element Methods [유한요소법]

The topics of this course include the theory and application of finite element methods stiffness matrices for triangular, quadrilateral, and isoparametric elements two- and three-dimensional elements; algorithms necessary for the assembly and solution; direct stress and plate bending problems for static, nonlinear buckling and dynamic load conditions; and displacement, hybrid, and mixed formulations.

UIE509 Urban Design Workshop [도시설계워크샵]

Examines urban design theory and principles, and evaluates the built environment in a studio-based setting. Working in teams, students become immersed in real work examples and propose design interventions for specific places, including socially diverse neighborhoods in small cities and major metropolitan urban centers.

UIE510 Advanced Engineering Mathematics [고급공학수학]

This course covers the basics of graduate-level applied mathematics for students majoring in engineering. Topics include complex variables, integral transformations, and partial differential equations.

UIE601 Prestressed Concrete [프리스트레스트 콘크리트]

This course discusses the strength, behavior, and design of prestressed concrete members and structures subjected to flexure, shear, and torsion, with special emphasis on pre-tensioned, precast construction. Unbonded post-tensioned members and composite prestressed beams are also introduced. The course materials also cover the evaluation of prestress losses, short-term and long-term deflections, bond between strand and concrete, and anchorage zone cracking and reinforcement.

UIE602 Crack Analysis in Concrete [콘크리트 균열해석]

Concrete structures are full of cracks. Their failure involves stable growth of large cracking zones and the formation of large fractures before the maximum load is reached. This course reviews the mechanism and analytical techniques for the cracking, which includes fracture mechanics of concrete and nonlinear mechanics of reinforced concrete.

UIE603 Time-Dependent Properties of Concrete [콘크리트 시간의존적 특성]

Creep refers to long-term deformation, usually for several years in the case of concrete, when a material is under constant load. Even within short time, large amount of creep is observed at early age of concrete, which sometimes causes a problem on the construction of high-rise buildings and piers. In the period, shrinkage is accompanied and affects the dimensional stability of early-age concrete. Thermal deformation due to heat and its transfer of hydration is also an important time-dependent property to be considered for the safety and serviceability of concrete structures.

UIE605 Real Estate Development and Investment [부동산 개발 및 투자]

The dynamics of real property development from the developer's perspective covering market research, government relations, site planning, financing, investment analysis, construction and project management, and marketing.

UIE701 Stability of Structures [구조안정론]

This course introduces principle theories and applications of structural stability that is essential in modern design of steel structures. A wide variety of stability problems are provided including elastic/inelastic buckling of bar and frames, torsional buckling, lateral buckling of beams, and buckling of rings, arches and thin plates.

UIE702 Nonlinear Finite Element Analysis [비선형 유한요소해석]

This course provides a comprehensive description of nonlinear finite element analysis for solid mechanics. It aimed to understand various approaches and difficulties inherent in nonlinear analysis as follows: Lagrangian and arbitrary Lagrangian-Eulerian formulation, explicit or implicit time integration methods, and handling nonlinear constitutive laws and structural stability.

UIE704 Concrete Micro-characterization [콘크리트 미세구조분석]

This course covers two promising structural concretes: fiber reinforced concrete (FRC) and geopolymer concrete. This course discusses various topics on these two materials from practical view for commercial use to in-depth research topics. All students are required to perform experimental research on these two materials using the following materials characterization techniques: X-ray diffractioin and Scanning Electron Microscope (SEM) and to turn in the research term-papers at the end of quarter.

UIE706 Urban Regeneration [도시재생]

Analyzes how economic, social, physical conditions of central cities can be improved through large-scale urban-planning efforts Understand the process of neighborhood revitalization and the main planning issues for the process.

UIE707 Theory of Planning [계획이론]

The logic of planning as a professional activity and Construction of methodologies for evaluating various theories of planning. Critical overview of current process theories leading students to develop a personal philosophy applicable to their work as planners.

UIE708 Planning for Housing [도시주택론]

The role of housing in urban planning supply and demand of the housing market and analysis of public policies for housing as they affect special consumer groups (the poor, the elderly, and the minorities).

UIE802 Rheology of Concrete [콘크리트 레올로지]

Concrete experience solidification from fluid. Its rheological properties before setting of concrete are critical for casting and construction of concrete structures. This course reviews fundamentals of fluid mechanics and rheology of unset concrete.

UIE803 Regional Economic Modeling [지역경제 모델링]

Examines the theories and limitations of input-output models, sources and weaknesses of the data, and validity of economic impact studies. Students are expected to complete a regional impact study with a sound knowledge of the inherent theoretical and data issues.

UIE804 Urban Modeling and Simulation [도시 시뮬레이션]

Urban modeling and simulation is an essential analytic technique for scenario planning. This course addresses two popular urban modeling and simulation techniques: space syntax and agent-based simulation model. After successfully completing this course, the students will be able to understand the modeling process and apply the techniques to analyze urban planning and design issues.

UIE810 Special Topics in Urban Infrastructure Engineering Ⅰ [도시기반시설공학특론 Ⅰ]

This course introduces new research topics in urban infrastructure engineering.

UIE811 Special Topics in Urban Infrastructure Engineering Ⅱ [도시기반시설공학특론 Ⅱ]

This course introduces new research topics in urban infrastructure engineering.

UIE812 Special Topics in Urban Infrastructure Engineering Ⅲ [도시기반시설공학특론 Ⅲ]

This course introduces new research topics in urban infrastructure engineering.

UIE813 Special Topics in Urban Infrastructure Engineering Ⅳ [도시기반시설공학특론 Ⅳ]

This course introduces new research topics in urban infrastructure engineering.

UIE814 Special Topics in Urban Infrastructure Engineering Ⅴ [도시기반시설공학특론 Ⅴ]

This course introduces new research topics in urban infrastructure engineering.

UIE590 Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

DME502 Structural Reliability [구조신뢰성]

The aim of this course is to offer a comprehensive review of reliability analysis methods and their applications to civil and structural engineering problems. In this course, students will learn several

probabilistic approaches for structural reliability assessment including first- and second-order reliability methods, system reliability methods and sampling-based methods. As a final project, each student will be asked to model his/her own structural reliability problem and to solve it using one of the reliability analysis methods covered in this course.

DME503 Disaster Response and Recovery [재난대응 및 복구]

This course examines the theory and practice of response and recovery, including response variance and effectiveness. This course provides knowledge on immediate and long-term aspects of management of the post-impact phase of a disaster. The aim is to generate understanding of specific actions that should be taken during the post-impact stage of a disaster to facilitate its effective management.

DME504 Surface Hydrology [지표수문학]

This course is concerned with descriptive and quantitative hydrology dealing with the distribution, circulation, and storage of water on the earth's surface. Topics cover principles of hydrologic processes, advanced methods of analysis and their applications to water resource problems including the management of water resource facilities and flood control.

DME505 Disaster Mitigation and Preparedness [재난완화 및 대비]

This course discuss the variety of actions taken by individuals, households, businesses, communities, and governments to both prepare for the impact of disasters and offer realistic strategies to mitigate the adverse consequences of disasters. This course will explore hazard mitigation and preparedness procedures, programs, and planning through case studies.

DME506 Numerical Weather Prediction [수치 예보]

This course introduces the basics concept of numerical modeling for weather prediction and provides student with the relevant numerical methods (e.g., grid and spectral methods). In addition, students study how to apply numerical methods to practical researches such as weather forecast.

DME507 Climate and Air Pollution: Integrated Approach [기후와 대기환경: 통합적 접근]

This course focuses on the inter-impact between climate and air pollution. Especially, students will study the impact of the air pollution on climate adaptation and mitigation through co-benefit and trade-off effect.

DME508 Introduction to Safety Design [안전디자인 개론]

Safe city design is based on four lines of specialized branches: 1)traffic safety-Traffic calming is a measure to slow down traffic flows, 2)fire prevention-to establish evacuation routes and to make people and fire fighters move faster, 3)crime prevention-surveillance and access control, 4)Disaster prevention & mitigation. The four lines of design philosophy have contradictory characteristics. This course will provide the basic knowledge of traffic safety, fire prevention, crime prevention, and

disaster prevention & mitigation. Finally, this course will find a “Comprehensive Safety Design Model” that are creative and harmonious design principle.

DME509 Geotechnical Earthquake Engineering [지반지진공학]

This course introduces fundamental concepts of earthquake engineering related to geotechnical problems, principles of earthquake, wave propagation, dynamic soil properties, liquefaction and seismic design of various geotechnical structures. This course begins with an introduction to seismology and tectonics, and continues with discussion on deterministic and probabilistic seismic hazard analyses, as well as site response analysis. In addition, the responses of various geotechnical structures such as foundations, retaining structures, and slopes subject to earthquake loading are discussed.

DME601 Disaster Planning and Policy [재난계획 및 정책]

This course provides knowledge to appreciate the need for integrating disaster risk reduction aspects in development policy, planning and implementation. The purpose is to equip students with the skills to identify the linkages between disasters and development, and understand the formulation and application of appropriate development planning policies integrating disaster risk reduction. This course includes reviews and critiques actual plans and engages students in components of effective disaster planning within and across various jurisdictions.

DME602 Earthquake Engineering [지진공학]

The first part of this course will focus on hazard analysis with emphasis on earthquake. The concepts necessary to understand, classify, and analyze an earthquake. The following concepts will be presented: the nature, power, and source of an earthquake, the wave propagation theory from the source to the site of interest, the characterization of a ground motion through different intensity measures, Probabilistic Seismic Hazard Analysis (PSHA). The second part of this course will involve earthquake design. The calculation of the demand and capacity of a structure subject to earthquake load will be studied. The common foundations at the base of each seismic design code will be explained. The different analyses available to assess the structural response of a structure will be explained: response spectrum method, pushover analysis, non-linear time history analysis.

DME603 Wind Engineering [풍공학]

Earthquake is the major concern in the design of low and medium rise buildings but wind dominates the design process of tall buildings and long-span bridges. The scope of this course is to teach the fundamentals of wind engineering and the design criteria for wind load. The students will learn how to predict the wind hazard at the location of the structure given the surrounding environment and how to compute the wind load given the properties of the hazard and the shape of the structure. Phenomena such as buffeting, vortex shedding, galloping and flutter will be explained in detail. Wind is treated with an equivalent static load in low medium rise buildings but for tall building and long-span bridges dynamic analysis must be used.

DME604 Reliability of Infrastructure Systems [사회기반시설시스템의 신뢰성]

This course will present the different methods used to estimate: the vulnerability of individual components and the reliability of entire civil infrastructures systems including distributed systems and complex systems. Examples of distributed systems are highway networks, power grids, water distribution systems. Examples of complex systems are nuclear power plants, dams, and chemical plants. Special consideration will be given to event tree analysis and fault tree analysis for complex systems, and Monte Carlo simulation for distributed systems.

DME701 Disaster Theory and Practice [재난이론과 응용]

This course reviews the theoretical assumptions and foundation of disaster management from the interpersonal, small group, organization and societal levels.

DME702 Advanced Numerical Modeling for Weather [고급기상수치모델링]

This course provides students with advanced techniques of the atmospheric numerical modeling such as objective analysis, data assimilation, physics parameterizations and boundary condition improvement.

DME703 Random Vibrations [불규칙진동론]

This course introduces probabilistic methods and applications to describe structural behavior under stochastic dynamic loads. Both time and frequency domain analyses to extract meaningful information from random signals are discussed. Theoretical and computer-aided approaches for data processing and analysis are covered.

DME704 Smart Structures [스마트구조]

This course introduces the basics of smart structure technologies and their applications to civil infrastructural systems. It covers smart materials, sensors, sensing, monitoring, assessment, retrofit, and control. Theoretical and experimental studies are conducted.

DME705 Micro-meteorology and Environment [환경미기상학]

The objective of this course is to understands the physical and dynamical characteristics of the atmospheric planetary boundary layer and the structure of local air circulation near the earth surface. Also students will learn how to apply the micro-meteorological knowledge onto the atmospheric environment problems.

DME801 Special Topics in Disaster Management Engineering Ⅰ [재난관리공학특론 I]

This course introduces new research topics in disaster management engineering.

DME802 Special Topics in Disaster Management Engineering Ⅱ [재난관리공학특론 II]

This course introduces new research topics in disaster management engineering.

DME803 Special Topics in Disaster Management Engineering Ⅲ [재난관리공학특론 III]

This course introduces new research topics in disaster management engineering.

DME804 Special Topics in Disaster Management Engineering Ⅳ [재난관리공학특론 IV]

This course introduces new research topics in disaster management engineering.

DME805 Special Topics in Disaster Management Engineering Ⅴ [재난관리공학특론 V]

This course introduces new research topics in disaster management engineering.

DME590 Seminar [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and find-tuned achievements through the Seminars.

CSA501 Introduction to Convergence Environmental Technolgies [융합환경기술개론]

The history and major disciplines of environmental engineering will be introduced for graduate students from different academic backgrounds. The goal of this course is to help students acquire a basic understanding of environmental engineering applications essential for convergence efforts.

CSA511/AHS111 Understanding Arts [예술의 이해]

This course introduces students to the use of arts and design to develop fresh approaches to creating new content in the arts, humanities, and technologies. Students explore diverse themes and topics in the contemporary arts, digital humanities, and product prototyping to create novel media objects or compositions through teamwork. Readings include a selection of classic and contemporary critical cultural texts from the arts and design.

CSA521 Scientific Methodology [과학기술방법론]

This course is on both scientific knowledge and artistic abstract, and also on the filosopia of convergence of science and arts. It encompasses fundamental observation procedures of nature, more detailed methodologies for knowledges and abstract, and underlying philosophy of the methods taken in this issue.

CSA561/AHS161: Introduction to Philosophy [철학 개론]

In this course we shall examine various philosophical views at the preliminary level. The aim of the course is to provide the students with a general introduction to seminal questions in philosophy, to lead them to engage in deep thinking and reflections on important matters in life, and to enable them to make their own arguments on a given issue in a critical and reasonable fashion.

CSA590 Convergence of Science and Arts Seminars I [과학예술융합 세미나 I]

The purpose of this course is to extend knowledge to the state-of-the-art R&D activities integrating science and arts in various fields. Students will be encouraged to share their ideas and thoughts to cultivate their ability of creative thinking.

CSA591 Convergence of Science and Arts Seminars II [과학예술융합 세미나 II]

The purpose of this course is to extend knowledge to the state-of-the-art R&D activities integrating science and arts in various fields. Students will be encouraged to share their ideas and thoughts to cultivate their ability of creative thinking.

CSA611/AHS211 Design Thinking [디자인 씽킹]

This class is a critical study over creative industry in contemporary art and design to make students familiar with basic perceptual concepts as well as two-dimensional and three-dimensional visual concepts. It moves into a more sophisticated problem-solving environment in which structure, organization, composition, proportion, scale will be emphasized. Proportional systems and ratios, Gestalt phenomena, scale relationships and design thinking problem-solving methodologies are some of the specific concepts that will be covered.

CSA661/AHS261 Contemporary Philosophy [현대 철학]

This course deals with the central issues of contemporary philosophy. We will discuss in depth at least one of the main branches in philosophy such as metaphysics, logic, ethics, philosophy of science, and philosophy of mind. Since the issues covered in contemporary philosophy are diverse, the specific contents of the course may vary. There are no prerequisites for this course.

CSA710/AHS310 Topics in Arts [예술 특강 (with Subtitle)]

This course focuses on a special topic in the field of arts. The particular contents of this course will be chosen by the instructor each semester when it is offered.

CSA711~CSA720 Special Topics in Science and Arts I~X [과학예술특론 I~X]

It is the project based class which is designed to tell students into contributing to necessary activitie to solve existing problems of community where we live. Students are asked to design the methodologies of classes to work on project(s), from strategic plannings to working realities. Students may solve the problem which they also select in scientific, artistic, or multidisciplinary ways. Classes are to be held on the sites which all the activities happen: laboratory, studio, working place, and even in-between those. Students are subject to submit their reports with flexible formats and to exhibit those as either scientist, engineer, philosopher, or artist, at the end of the semester.

CSA760/AHS360 Topics in Philosophy [철학특강 (with Subtitle)]

This course focuses on a special topic in the field of philosophy. The particular contents of this course will be chosen by the instructor each semester when it is offered.