Civil and Environmental Engineering

Ⅰ Educational Goal

The educational goal of graduate courses in civil and environmental engineering is to train professional engineers who can contribute to social and engineering development through an enhancement of education and research activities based on major knowledge.

Ⅱ Educational Objective

① Training a professional civil engineer with practical field experience.

② Building up research ability to work together in collaboration with school, institute, and industry

③ Encouraging of submissions of journal papers (more than 1 for M.S. course, 2 for pH.D. course)

④ Understanding state-of-art development in major subjects through joining conferences

⑤ Training foreign language and computer based work to meet technetronic and global issues

Ⅲ List of Full-time Faculty

Name	Position	Degree(University)	Field of Instruction	Area of Research
Oh, Ju-Won	Professor	pH.D. (Jeonbuk Univ.)	Civil Engineering	Structural Engineering
Jeong, Dong Kug	Professor	pH.D. (Seoul National Univ.)	Civil Engineering	Water resources

Lee, Hack-Soo	Professor	pH.D. (Univ. of Michigan)	Civil Engineering	Structural Engineering
Jung, Tae-Sung	Professor	pH.D. (Univ. of Rhode Island)	Civil Engineering	Environmental Hydraulics
Jin, Myung-Sub	Professor	pH.D. (Univ. of Rhode Island)	Civil Engineering	Road Engineering
Kim, Geon Ha	Associate Professor	pH.D. (Univ. of Texas A&M)	Civil Engineering	Environmental Engineering
Kwon, Seung-Jun	Assistant Professor	pH.D. (Yonsei Univ.)	Civil Engineering	Concrete Engineering
Min, Kwan-Sik	Full-time lecture	pH.D.(Chungnam Univ.)	Civil Engineering	Concrete Engineering

Ⅳ Course Description

• CI601 Advanced Structural Analysis 3 credits

This is a advanced course of the structural analysis which has been learned in undergraduate courses. It provides students with a more profound technique for structural mechanics with emphasis on energy and matrix methods used primarily for the analysis of framed structures. This course also covers the review of classical methods such as energy method, moment distribution method, and slope deflection method. The fundamentals of stiffness and displacement methods are studied and applied to the real structures using structural analysis software.

• CI602 Design of Steel Structures 3 credits

This course shows how the principles of mechanics and structural analysis can be applied in practical design of steel structures. Five basic structural members of steel structures are studied: tension members, columns, beams, beam-columns, and connections. The class is based on the Load and Resistance Factor Design (LRFD) code from the American Institute of Steel Construction (AISC). In parallel with the regular lectures, a number of analysis/design projects is conducted in team-teaching.

• CI603 Introduction to Finite Element Method 3 credits

All physical problems in the area of civil engineering are described by differential equations. The finite element method is one of the numerical methods that can be used for

approximation solutions. It is the most common numerical tool for analysis of various structural systems. In this course the students can use the finite element method to analyse structures composed of spring, truss, and beam elements under static loads for the cases when the deformations and strains are small. The students are able to describe, explain and derive the different steps used in the formulation of the finite element method for analysis of static problems with small deformations and linear elastic material.

• **CI604 Advanced Finite Element Analysis 3 credits**

In this course the introduction of FEM is reviewed and the students can use the finite element method in an effective way to analyse structures composed of plate, shell, and solid elements for 3-D problems. The students are able to describe, explain, and derive the different steps used in formulation of the finite element method for analysis of the structures under dynamic loads and nonlinear materials.

• **CI605 Structural Dynamics 1 3 credits**

This course shows the vibration analysis of structures. The students understand the fundamentals of vibration theory and applications in structural engineering under dynamic loads. Free, forced, and transient vibration of single and multi-degree of freedom systems are covered including damping, normal modes, coupling and normal coordinates.

• **CI606 Bridge Engineering 3 credits**

This course contains major aspects of bridge engineering; analysis, design, detailing, and construction using Korean Highway Bridge Design Specifications and identification of bridge types and bridge components. The students learn to perform the analysis and design of steel girder bridges and concrete bridges for maximum moving load effects, design of composite girders, and fatigue design

• **CI607 Advanced Reinforced Concrete 3 credits**

Theory, design and application of reinforced concrete in compliance with the Korean Structural Design Code are studied. The students are required to perform a design project using a response spectrum of a two-story building. They are assigned readings from journals and a research term paper covering behavior of reinforced concrete systems, design codes, and design applications for wind and seismic effects. they learn to utilize code based concrete finite element programs in design of footings, shear walls, beams and columns.

• **CI608 Theory of Plate and Shells 3 credits**

This class contains a review of the theory of elasticity, formulation of general equation of bending of thin elastic plates, methods of obtaining exact and approximate solutions, membrane and bending theories of shells with emphasis on cylindrical shells.

• **CI609 Theory of Elasticity 3 credits**

This course covers classical elasticity theory. The course begins with introduction to the concepts of tensorial stress and strain, then develops the basic mathematical equations of linear elastic media, including compatibility, equilibrium, and Hooke's Law. The Airy stress function is developed and used to solve classic two-dimensional problems fundamental to stress analysis. Specific classes of problems are addressed such as plane strain, axisymmetric, crack in infinite media, dislocations and contact. Concepts of stress concentration, singularities and residual and thermal stresses are discussed

• **CI610 Continuum Mechanics 3 credits**

The course involves the interpretation of load and deformation in terms of tensor. The analysis of stress and deformation at a point is performed to help students become familiar with tensor operations and their applications in mechanics. The derivation of the fundamental equations by applying the basic laws of conservation of mass, energy, and momentum and those of thermodynamics are also covered. Vector and Cartesian tensors are reviewed. Relationships (constitutive laws) are then developed between stress, strain, and strain rate. The basic equations governing the behavior of any continuum and applications to solids and fluids are covered.

• **CI611 Advanced Numerical Analysis 3 credits**

This course includes the theory and application of numerical approximation techniques. The students learn to identify the type of problems that require numerical techniques for their solution. They also learn the theory of numerical analysis and computer methods applied to various cases.

• **CI612 Fluid Dynamics Ⅱ 3 credits**

The fundamental concepts of fluid mechanics, conservation of mass, energy, and momentum, are reviewed. Both physical and mathematical descriptions of basic concepts of continuum mechanics and fluid mechanics, fluid motion and deformation, stresses, and external forces such as gravitation are performed Turbulence, the Bernoulli equation, potential theory, the momentum theorem, boundary layer theory, pipe and open-channel flow, and fundamental principles to coastal hydraulics, groundwater hydraulics, and sediment transport are also covered.

• **CI613 Open Channel Hydraulics and Lab. : 3 Units 3 credits**

Advanced hydraulics of free surface flow in rivers and open channels is studied. This also includes discussion of theory, analytical and numerical solution techniques, and their applications to gradually and rapidly varied nonuniform flows, unsteady flow, and flow in open-channel networks. This class requires a prerequisite of Applied Hydraulics and Lab.

• **CI614 Applied Hydrology: 3 Units 3 credits**

This class is a study of descriptive and quantitative hydrology dealing with the distribution, circulation, and storage of water on the earth's surface. This discusses principles of hydrologic processes and presents methods of analysis and their applications to engineering and environmental problems. This course also require a prerequisite class in Hydrology.

• **CI615 Computational Hydraulics 3 credits**

Basic concepts and programming of finite difference and finite element methods are studied for solving partial differential equations related to hydraulics. The computer projects for numerical solution of potential flows, parabolic equations and hyperbolic equations are assigned to students.

• **CI616 Advanced Hydraulics: 3 Units 3 credits**

This class covers review of mathematical and physical concepts of hydraulics from a general point of view. This also contains steady incompressible flow in pipes, steady and unsteady flow in open channels, environmental hydraulics, coastal hydraulics, groundwater hydraulics, turbulent flow, and sediment transport.

• **CI617 Coastal Engineering 3 credits**

This class deals with subjects related to the design and construction of coastal structures which are important structures of civil engineering. This class contains fundamentals of ocean wave mechanics, nearshore currents, coastal sediments, coastal survey, and environmental preservation of coastal and nearshore zones.

• **CI618 Advanced Soil Mechanics 1 3 credits**

This course provides the theories of soil mechanics. This includes failure conditions, mechanical interaction between solids and water, and problems in elasticity and plasticity pertaining to earthwork engineering.

• **CI619 Advanced Soil Mechanics 2 3 credits**

This course is a consecutive class following Advanced Soil Mechanics 1. This course covers drainage of soil, shear strength in various conditions, stability, compaction, and various footing and foundation.

• **CI620 Foundation Design and Analysis 3 credits**

This class covers subsoil investigations, excavations, design of sheeting and bracing systems, control of water, footing, grillage and pile foundations, caisson and cofferdam methods of construction. This also deals with the behavior and design of retaining walls and shallow foundations.

• **CI621 Soil Stabilization 3 credits**

This class has principles and design methodologies for techniques related to densification, including dynamic compaction, vibro-compaction, and compaction grouting. This also provides the technique of drainage, including wick drains, horizontal drains and dewatering, physical and chemical modification, This also includes admixtures, chemical and cement grouting, soil mixing, jet grouting and soil freezing.

• **CI622 Design and Construction of Earth Dam 3 credits**

Theory and practice of numerical techniques are developed and applied to fluid flow and transport in earth dam systems. Additional topics include model conceptualization, grid design in multidimensional systems, practical applications of numerical models, calibration, validation, and prediction. This also provides concepts and techniques of advective transport using particle tracking and dispersive transport.

• **CI623 Mechanical Test of Soils 3 credits**

This class provides methods of testing and analysis of soil for engineering properties including compressibility, strength in triaxial, simple and direct shear, permeability, and stability.

• **CI624 Pavement Maintenance & Management: 3 Units 3 credits**

The effective maintenance and management of pavements are as important as skillful construction of pavements. Therefore, the purposes of this course are to make it possible to perform systematic and scientific management of pavements on actual affairs by teaching site investigation methods and software for pavement management. The main contents are distresses and rehabilitation methods of pavements, site investigation methods for evaluation of pavement performances, diverse maintenance methods of pavements, and software for pavement management.

• **CI625 Blast Vibration Engineering 3 credits**

Numerous blast works are being performed at civil engineering sites such as tunnel construction, subway construction, and redeveloping work in downtown areas. However, a systematic education on blast, like vibrations of foundation caused by blast and effects on surrounding buildings, is not performed well. This course provides the students with a basic understanding of blast vibration engineering by giving theoretical knowledge on blast and vibration. The main contents are typical vibration history, response spectrum, structure response, natural frequence and damping of structures, and blast design.

• **CI626 Water Quality Management 3 credits**

Management of water quality is discussed in this course with emphasis on regulations, modeling, and impact analysis of point sources and non-point sources on water quality.

• CI627 Urban Hydrology 3 credits

Rainfall runoff processes in the urbanized area and hydrograph theory are reviewed. Linear and nonlinear hydrologic system models are also investigated. New methods related to hydrologic and hydraulic streamflow routing, rainfall and flow frequency analysis and watershed models are also reviewed.

• CI628 Water Quality Model 3 credits

Various types of water quality models are discussed in this course. Conservative and non-conservative contaminants inputs to the surface water body including rivers, streams, reservoirs are discussed. Physical, chemical and biological phenomena are covered as well.

• CI629 Environmental Engineering Lab. 3 credits

This class contains advanced chemistry and chemical calculations applied to environmental engineering, lab methods, and interpretation of results for chemical and biological analyses of water and wastewater

• CI630 Water Supply and Sewer System Planning 3 credits

Water supply and demand prediction is the main issue covered in this course. Various techniques related to source water development, sewage network, and pumping facilities are covered in this course as well.

• CI631 Water Treatment Engineering 3 credits

This class is for advanced study of material and energy balances, reaction kinetics, and reactor design and their application to analysis and design of water quality control systems and processes. Simulation of dynamic systems, study of treatment process control fundamentals, and an introduction to describing the movement and transformation of pollutants in the natural environment are dealt with.

• CI632 Sanitary Landfill Design and Evaluation 3 credits

This course covers the characterization of waste from municipals and industries. Regulations, contaminant interactions with soils, landfill design, and leachate collection are the primary issues covered in this course.

• CI701 Optimum Design of Structures 3 credits

In all engineering problems, designers try to find solutions that show good performance, and satisfy several requirements. Using optimization techniques, engineers can obtain the optimum results, within the imposed conditions. Structures designed in this way are safer, more reliable and less expensive than the traditional designs. Nowadays, structural optimization is not only a consolidated research field, but it also has many practical applications in civil, mechanical, automobile, and aerospace engineering fields. This course will enable students to understand the main concepts of design optimization, to obtain a

general knowledge about the main methodologies to perform numerical optimization, to estimate the behaviour of the numerical optimization techniques in structural optimization, and to be aware of the capabilities of current commercial packages for structural optimization.

• **CI702 Structural Dynamics 2 3 credits**

This course involves the responses of structures and structural components having one or more degrees of freedom, damping and inelastic action, earthquake and nuclear blasts, dynamic resistance of structural elements and structures, and elastic and inelastic response of structures. Characteristics of earthquakes and seismicity response spectra, modal methods of analysis, practical examples of elastic and inelastic response of structures to earthquake motions, and computer applications are dealt with.

• **CI703 Advanced Prestressed Concrete 3 credits**

This course is designed to provide principles of prestressed concrete structures in Civil Engineering with the fundamentals and basic principles of prestressed concrete design and behavior. The students also learn properties of concrete and cable materials used in prestressed concrete bridges under the existing specifications. The various methods of manufacturing prestressed concrete are displayed.

• **CI704 Structural Stability 3 credits**

This course includes an introduction to common areas of stability problems in structures, conservative and non-conservative loads, and elastic and inelastic buckling of columns. This also includes stability of members under combined bending and axial loads, buckling of frames, torsional buckling of open sections, lateral stability of beams and buckling of thin plates and shells, and design considerations for stability.

• **CI705 Structural Reliability 3 credits**

This course includes fundamentals of reliability theory, system reliability analysis including common-mode failures, fault tree and event tree analysis, time-dependent reliability including testing and maintenance, propagation of uncertainty, human reliability analysis, and practical applications in component and system design.

• **CI706 Sediment Transport 3 credits**

This course deals with a basic concept of sediment transport and solving methods of sediment transport problems in natural rivers, lakes and oceans. The course includes a review of fundamental hydraulics related to sediment transport, theoretical background of sediment transport, numerical and experimental methods to analyze sediment transport phenomena, and technical countermeasures to lessen sedimentation and erosion problems. Cohesive sediments, which are very important in water quality engineering, are considered in this course together with non-cohesive sediments.

• **CI707 Wave Propagation 3 credits**

This course shows quantifying the wave climate, understanding the interaction of waves with structures and/or sediment, and predicting the associated reponses of interest. This also includes introduction to wave mechanics, small-amplitude water wave theory formulation and solution, engineering wave properties, long waves, wave statistics and spectra, and nonlinear waves.

• **CI708 Water Resources System Engineering 3 credits**

This course provides a study of basic concepts, theories, and techniques of systems analysis including modeling of large scale systems, forecasting, planning, control, and information handling. This also includes quantitative aspects of water in the earth environment and its engineering implications including design and analysis of systems directly concerned with the use and control of water. A quantitative introduction to hydrology, hydraulic engineering, and water resources planning is also covered. The prerequisite for this course is Water Resources Engineering.

• **CI709 Groundwater Hydraulics 3 credits**

This course includes physical properties of groundwater and aquifers, principles and fundamental equations of porous media flow and mass transport, well hydraulics and pumping test analysis, role of groundwater in the hydrologic cycle, groundwater quality and contamination. Its prerequisite is Applied Hydraulics and Lab.

• **CI710 Advanced River Engineering 3 credits**

This course provides advanced hydraulics of free surface flow in rivers and open channels, discussion of theory, analytical and numerical solution techniques, and their applications to gradually and rapidly varied nonuniform flows, unsteady flow, and flow in open-channel networks.

• **CI711 Environmental Hydraulics 3 credits**

This course deals with various contaminants and their transport in the water body. Theories related to contaminant transport are covered as well. Laboratory experiments related with contaminant transport are also covered in this course.

• **CI712 Theoretical Soil Mechanics: 3 Units 3 credits**

This course has Constitutive Laws for Soils, nonlinear elastic and plastic models. This also covers Consolidation, layered systems, sand drains, approximate three-dimensional theories, and Biot's poro-elastic formulation. Plastic equilibrium in soils, Sokolovski's method of characteristics, applications to earth pressure, bearing capacity, and slope stability problems are dealt with. Analysis of machine foundation problems, elastic waves through soils, and dynamic properties of soils are provided.

• CI713 Track Geotechnology 3 credits

The performance of a railway track system results from a complex interaction of the system components in response to train loading. The superstructure consisting of rails, fasteners and sleepers has received the most attention in the past. The substructure consisting of the ballast, the subballast and subgrade has been given much less consideration, especially the subballast and subgrade component, even though it has a major influence on the track maintenance cost. Track Geotechnology provides the properties of the substructure for the aquate construction and maintenance of the track.

• CI714 Soil Dynamics 3 credits

This course includes characteristics of earthquake motions, seismic risk analysis, design inputs response spectra and spectral density function, multi-degree-of-freedom, linear and nonlinear structures, spatial variation of ground motion, multiple support excitations of large structures, structure-soil interaction analysis, floor response spectra, nonstructural components and secondary systems, passive and active structural control base isolation, energy dissipation devices, active and semi-active devices, elevators and rotating machines.

• CI715 Advanced Highway Engineering 3 credits

This course is focused on the practical education needed to play a role in fields as pavement engineers by amending the contents of pavement engineering dealt with in undergraduate courses. The main contents are geometric designs of highway, comparisons of thickness designs of asphalt pavements, asphalt materials, pavement constructions, quality control methods in fields, and so on. It also helps students become more familiar with fields through slides or videos showing construction sites.

• CI716 Advanced Environmental Engineering 3 credits

Advanced topics related with the environmental engineering are discussed in this course. The topic includes air pollution, vibration, waste management, and water pollution.

• CI717 Advanced Air Pollution Control 3 credits

Advanced topics related with air pollution control are covered in this course. Topics include source identification, regulations related with air pollution, and diffusion rate related with air pollution.

• CI718 Wastes Treatment Engineering 3 credits

This course provides environmental regulations, remediation site characterization, contaminant characterization, detailed engineering and management considerations related to the design and operation of waste remediation systems involving water pollution, air pollution, solid waste, and groundwater pollution.

- Research for the Master's Degree 1
- Research for the Master's Degree 2
- Research for the Doctoral Degree 1
- Research for the Doctoral Degree 2
- Research for the Doctoral Degree 3