Dept. of Civil & Environmental Engineering

More than any other field of engineering, Civil and Environmental Engineering serves the basic needs of society through construction and maintenance of the public works and infrastructure, and pursues harmony with nature. Civil engineers are involved in planning, designing, researching, constructing, managing, and maintaining infrastructure systems such as bridges, highways, subways, airports, tunnels, seaports, water supply and reclamation networks, power generation and distribution facilities, transportation, and various environmental and sanitary facilities.

Each project has unique characteristics that challenge civil engineers to apply their knowledge with initiative and creativity to fulfill the objectives, protect society, and meet the construction and operating budgets. These complex goals require not only knowledge of engineering, but also knowledge of the social, economic, and managerial sciences and collaboration with experts in these areas. The field of Civil Engineering has expanded lately into biotechnology for environmental restoration and into materials for construction and other uses. The types of projects in which Civil and Environmental Engineers are involved vary widely, but they are all broadly based on a system of shared knowledge and scientific principles of mechanics, systems analysis, mathematical tools, properties of materials, engineering design principles that ensure safety, reliability, and economy.

Research that seeks to improve projects and systems as well as engineers' capabilities is an important activity in the department of Civil and Environmental Engineering at Kookmin University. Our department is nationally recognized for its leadership in research and education. Our faculty are known nationally for their strong research activities, supported by extensive external funding. Our programs give graduate students a solid foundation to begin careers in professional practice and research.

❑ Structural Engineering major

The structural engineering program of the Department of Civil and Environmental Engineering, in Kookmin University, offers excellent opportunities for study and research leading to advanced degrees in the areas of structural analysis and design, mechanics of structures, and materials in structures and construction. The active involvement of our faculty in many research projects and in the solution of challenging real world engineering problems results in an instructional program that is up-to-date and relevant. Graduates from our program have gone on to become leaders in private practice, government service, education, and research.

❑ Geotechnical Engineering Major

Geotechnical engineering merges geotechnics, geophysics, geomechanics, and geology and focuses on the behavior of natural materials in engineered systems. The

geotechnical engineering program at Kookmin University encompasses both traditional and emerging topics in the field, including advanced techniques for site and material characterization; constitutive and micromechanical modeling; natural and man-made hazard mitigation; engineered soils; and foundation design, slope stability, and excavation support.

❑ **Hydraulic Engineering Major**

Hydraulic Engineering major deals with water related problems in civil engineering. This field of study can provide hydraulic or hydrologic data for hydraulic structures, such as pier, levee, bank, breakwater, harbor, dam, reservoir, floodplain, etc. Hydraulic structures protect us against water related natural disaster, like flood, drought, tsunami, etc. The courses in hydraulic engineering major are fluid mechanics, hydraulics(Ⅰ and Ⅱ), hydrology, coastal engineering, port engineering, water resources engineering, etc.

❑ **Environmental Engineering Major**

Environmental Engineering aims to protect nature and humans from artificial pollutants while preserving the ecosystem. It is a study for ensuring health, safety, and well-being of human life by improving and preserving quality of our surrounding environment. This major will cover water pollution, water environment system solid waste & water pollution treatment, waste resources, advanced water and wastewater treatment, **seawater desalination, wastewater reuse,** and environmental analysis.

☐ **Courses**

❑ **Core Courses**

· **Advanced Numerical Methods for Engineering (3)**

Introduction to computer programming with the emphasis on numerical techniques as applied to engineering problems. Development of mathematical models and computer programs using a compiled language (FORTRAN). Formulation and solution of initial and boundary value problems with emphasis on structural analysis, fluid flow, and transport of contaminants.

· **Fundamentals of Finite Element Method (3)**

Basic knowledge of finite element method and FEM theories based on energy principles will be studied. Basic development of element model, programming, and examples will be treated.

· **Theory of structural reliability (3)**

Review of concepts of probability theory, lean, analytical and numerical methods for reliability analysis and apply them for civil engineering problems.

· **Digital signal processing in civil engineering (3)**

The fundamental theories and applications of digital signal processing on civil engineering will be covered. Civil engineering signals and systems. Discrete time and frequency domain operations. Inverse problems. Matrix-based and other solutions. Tomography. Civil engineering examples.

· **CAD in civil engineering (3)**

Learn how to draw 2D and 3D digital plans for design and finite element analysis in civil engineering field, and apply drawing techniques to real in-depth civil projects.

· **Safe construction technology (3)**

The construction techniques to mitigate the natural hazards such as earthquake, typhoon and inundation will be reviewed. The scientific/engineering principles of those techniques will also be covered.

· **Esthetic Aspects of Civil Structures (3)**

Study shape, color, texture, proportion, balance, harmony, characteristics of formation, design concept of civil structures, and investigate on relation between structure shape and mechanical safety.

❑ **Structural Engineering Major Courses**

· **Advanced Structural Mechanics (3)**

Structural analysis using energy principles, stiffness method, flexibility method, analysis of special structures, torsional and bending theory for thin-walled members, and fracture theories will be learned.

· **Advanced Construction Materials (3)**

Hydration of cement, concrete mixture design, curing of concrete, construction, special concrete, concrete durability, various experimental methods, mechanical properties of fresh and hardened concrete are studied.

· **Advanced Design of Concrete Structures (3)**

Advanced analysis method including strut-tie method will be studied. Various characteristics of concrete including time dependent behavior, durability, strain-softening, experimental techniques, inelastic and plastic analysis, and fracture mechanics will also be covered.

· **Advanced Steel Structure Design (3)**

General torsion of thin-walled open, closed, and combined open and closed

sections: general instability of thin-walled members: consideration of residual stress: fatigue strength.

· **Experimental Stress Analysis (3)**

State of stress, stress-strain relationship, strain measurement, strain gages, strain gage circuits, analysis of strain gage data, basic optics, theory of photoelasticity, and Moire method will be studied.

· **Advanced Bridge Engineering (3)**

Design load for bridges: analysis and design of late girder, box girder bridges, truss bridge, arch bridge: behavior of cable supported bridges: construction method such as FCM, ILM, etc.

· **Theory of Elasticity (3)**

Selected problems of stress and strain in rectangular and polar coordinates. Failure theorem. Torsion and bending of bars.

· **Dynamics of Structures (3)**

Single degree of freedom system and multi degree of freedom system of beams, frames, plate members subjected to free vibration, dynamic loading will be analyzed. Introduction to seismic design will also be studied.

· **Finite Element Analysis (3)**

Development of finite elements for plate, shell, rigid body motion will be studied. Galerkin method, dynamic analysis using FEM, and nonlinear analysis will be studied.

· **Fracture Mechanics (3)**

Fracture behavior in solids, linear elastic fracture mechanics: stress analysis of cracks: generalization of fracture criteria: fracture toughness testing: fatigue analysis and fracture control plan.

· **Advanced Composite Structures (3)**

Classification and characterization of composite materials. Behavior in the elastic range. Stress strain relations for anisotropic media. Orthotropic laminae. Plane problems. Theory of anisotropic plates. Bending, buckling and vibrations of laminated plates.

· **Advanced Prestressed Concrete Design (3)**

Fundamental principles of prestressed concrete analysis, prestress losses, flexural analysis, flexural design, shear and torsion, composite beams, continuous beams, and various applications of PSC will be studied.

· **Stability of Structures (3)**

Elastic and inelastic buckling of column and thin-walled members: lateral torsional buckling: stability problem of plate and shell including post buckling strength: Approximate and numerical methods of solution.

· **Theory of Plates and Shells (3)**

Plates and slabs loaded transversely in their plane. Buckling and post buckling behavior of elastic and inelastic plates. Membrane and bending analysis of cylindrical, rotational, hyperbolic shells.

· **Special Topics in Structural Mechanics (3)**

Special topics in structural mechanics issues will be studied.

· **Special Topics in Structural Engineering (3)**

Special topics in structural engineering issues will be studied.

· **Cold-Formed Steel Structure Design (3)**

Analysis and design for the composite panels consist of cold formed steel wall studs with wallboard are introduced. Typical failure mode estimation due to global and local bucklings according to specific design manual are also included.

· **Non-destructive analysis (3)**

Ultrasonic methods of inspection, acoustic methods of inspection, visual methods of inspection, vibration methods and modal analysis, application of NDE inspection in Engineering problems will be studied.

· **Seismic Design (3)**

Study theories for seismic design, and practice seismic design for general, nuclear or special structures.

❑ **Geotechnical Engineering Major Courses**

· **Advanced Geotechnical Engineering (3)**

Application of geotechnical theories and principles in construction engineering practice. Introduction to tho following topics in practice: Slope stability, retaining structures, shallow and deep foundations, soil improvement, and so on

· **Advanced Soil Mechanics (3)**

Identification and evaluation of physical, chemical and mechanical properties affecting the engineering behavior of geomaterials

· **Advanced Foundation Engineering (3)**

Soil exploration, sampling, and in-situ testing techniques. Bearing capacity, stress distribution, and settlement. Design of shallow and deep foundations

· **Subsoil Exploration (3)**

Field and laboratory testing and sampling of geomaterials, primarily soils and rocks. Methods of drilling, probing, and in-situ measurements to determine stratigraphy and engineering parameters for analysis

· **Numerical Mehthods in Geotechnical Engineering (3)**

Numerical methods and techniques to resolve geotechnical engineering problems using computer softwares with emphasis on various geotechnical engineering examples

· **Seepage through Soil (3)**

Theory of water transportation through soils. Application of seepage theory to practical civil engineering problems. Introduction to embankment and dam engineering

· **Soil Behavior (3)**

Mechanical response of soils with respect to the various stress states e.g. geostatic loading and stress history issues. Evaluation of stress-strain relationships, undrained drained shear strength, compressibility and hydraulic conductivity of soils using laboratory and field testing methods

· **Soil Improvement (3)**

Introduction to various soil improvement by using enforced drainage, dynamic compaction, grouting, explosion compaction, etc. Case studies of soil improvement.

· **Soil Dynamics (3)**

Principles of dynamics. Soil behavior under monotonic dynamic loading conditions. Foundation design for vibratory loadings. Introduction to earthquake engineering. Design of embankments and retaining structures under earthquake.

· **Dam Engineering (3)**

Principles of analysis and design for earth and rockfill dam structures. Construction materials, construction methods, internal and external stability, seepage and drainage, performance monitoring, abutment and foundation design.

· **Advanced Retaining Structure Analysis (3)**

Earth pressure theories. Design of rigid, flexible, braced, tied back, slurry, and reinforced walls. Stability of excavation, cut, and natural slopes.

· **Rock Mechanics (3)**

Geological and engineering classifications of intact rock, discontinuities, and rock masses. Laboratory and field evaluation of rock properties. Design of foundations on, and openings in rock masses. Analysis of rock slope stability.

· **Excavation Engineering (3)**

Introduction to excavation methods. Equipments for excavation. Stability and safety analysis of excavated faces. Support systems for excavation.

· **Special Topics in Soil Mechanics (3)**

Special research topics related to soil mechanics are selected by the students with the advice of the faculty members in charge and are pursued either independently or in conjunction with others.

· **Special Topics in Foundation Engineering (3)**

Special research topics related to foundation engineering are selected by the students with the advice of the faculty members in charge and are pursued either independently or in conjunction with others.

· **Soils and Waves (3)**

Characterization of materials with mechanical and electromagnetic waves. Emphasis on particulates with extensions to other materials. Laboratory and field applications.

❑ **Hydraulic Engineering Major Courses**

· **Flow in Open Channel (3)**

Energy and momentum principles in open channel flow: uniform flow: gradually varied flow: rapidly varied flow: unsteady flow: flood routing.

· **Advanced Mechanics of Fluids (3)**

Basic concepts and definitions: pressure distribution in a fluid: governing equations and boundary conditions: integral and differential analysis: dimensional analysis and similarity: experimental analysis: laminar and turbulent internal and external flows: potential flows: engineering applications.

· **Computational Hydraulics (3)**

General review of numerical methods: one dimensional unsteady flow: quasi two dimensional unsteady flow: unsteady dispersion in rivers: water and sediment routing in rivers: calibration.

· **Advanced Hydrology (3)**

Hydrologic cycle, processes, observations: flood flows, hydrologic design using

statistical methods.

· **Hydrodynamics (3)**

Hydraulics of pressure conduits and open channels, dimensional analysis, flow measurements, hydraulic machinery, with laboratory.

· **Coastal Hydrodynamics (3)**

Waves, tides, harbor oscillations: coastal structures, estuary dynamics, salinity intrusion, sediment transportation in estuaries: beach processes and evolution.

· **Water Resources System (3)**

Planning and economics of water resources projects: stochastic basis of design: flood control: river navigation works: hydraulic machinery: hydroelectric power systems: classification, functions of hydraulic structures: hydraulic design of spillways, energy dissipators, gates, outlet works: design of canal, other water conveyance structures: design of municipal and industrial outfall structures.

· **Stochastic Hydrology (3)**

Common probabilistic models used in hydrology, hydraulics, and water resources: derived distributions: multivariate model sand estimation of model parameters: analysis of data and model building: uncertainty analysis.

· **Mechanics of Sediment Transport (3)**

Laws governing fall velocity, applications to particle size analysis: incipient motion, bed forms, bed load, suspended load, natural river processes: theory and practive of movable bed model experiments.

· **Porous Media Hydrodynamics (3)**

Governing equations of groundwater flow through porous media: interaction of surface and groundwater flows: groundwater contaminant transport: numerical methods, parameter estimation applications to groundwater models: hydraulics of wells: seepage analysis, land drainage systems.

· **Hydraulic Analysis of Unsteady flow (3)**

Unsteady flow in closed conduits: method of characteristics: transients caused by centrifugal pumps: transients in power plants: resonance: transient cavitation: surge tanks: transients in open channels:

· **Hydraulic Modeling (3)**

Review of theory: importance of experiments: modeling and scaling laws: experimental environment and facilities: measurements at full scale and on scaled models: use of wind and water tunnels, towing tanks, hydraulic flumes: instruments

for measuring pressure, temperature, velocity, turbulence: error analysis: data acquisition and processing: laboratory demonstrations, hands on experiments, project.

- **Mixing in Water (3)**

  Review of classical diffusion theories: longitudinal dispersion, transverse and vertical mixing in free surface turbulent shear flow: application to natural channels: selected topics including stream tube models, mixing and dispersion of heated effluents.

- **Special Topics in Coastal Engineering (3)**

  Presentation and discussion of selected topics relating to coastal engineering. A wider range of matter and method permissible.

- **Special Topics in Hydraulic Engineering (3)**

  Presentation and discussion of selected topics relating to hydraulic engineering. A wider range of matter and method permissible.

❑ **Environmental Engineering Major Courses**

- **Advanced Water Supply Engineering (3)**

  This course covers design water treatment processes including conventional and advanced treatment processes through basic principles and experiments.

- **Advanced Wastewater Treatment Engineering (3)**

  Process design of wastewater treatment plants, including primary, secondary and advanced treatment through understanding wastewater treatment principles and experiments.

- **Advanced water pollution (3)**

  Topics include the cause and damage of water pollution, the control techniques of water quality through theoretical and experimental practice.

- **Water supply network design (3)**

  Topics include various tools for the analysis of water supply networks, optimum design and autocad of water supply networks.

- **Sewage system design (3)**

  Topics include optimum design and drawing of sewer system using computer simulation.

- **Industrial Wastewater Treatment (3)**

  Topics include fundamentals of chemical, physical, and biological unit processes,

and application of the processes for the wastewater treatment.

· **Solid Waste Treatment and Disposal (3)**

Topics include techniques of collection, transport, and treatment of solid waste. It also covers final treatment processes such as incineration, landfill, and resource recovery, and associated groundwater pollution and site remediation.

· **Environmental Impact Assessment (3)**

Topics of legislative requirement, environmental effect, impact prediction and assessment methodologies to be included in project planning and construction.

· **Special Topics in Pollution (3)**

The course discusses the environmental and sanitary issues, especially water and wastewater systems in a seminar format.

· **Special Topics in Environment (3)**

The course discusses the environmental and sanitary issues, especially water, air, and solid waste treatment in a seminar format.

· **Water purification facility design (3)**

Fundamental principles in constructing water purification systems. Major topics include the planning and management of water resources and integrated designs of municipal water treatment plants and sludge discharge facilities including water distribution system, and pumping stations. Practical design exercises are provided.

· **Wastewater treatment facility design (3)**

Design and theoretical understanding of environmental processes in wastewater treatment; mainly physical and chemical processes, and reactor configurations commonly used for effluent quality control; applications to the design of specific wastewater treatment plant operations.

· **Conservation of aquatic environment (3)**

This course will cover the progress of understanding environmental problem in rivers, lakes and reservoirs. The subject matter includes effects on nature and ecosystems from human activities.

· **Industrial Waste Water Treatment plant design (3)**

This course will examine industrial wastewater sources and characteristics, significance of industrial wastewater as environmental pollutants and application. It also cover various unit processes of physical, chemical and biochemical treatment in industrial wastewater treatment plants.

· **Solid waste treatment plant design (3)**

The course will cover theory, planning, and application of sources and characteristics of municipal solid waste, physical/chemical composition, storage, collection, transportation, and treatment and disposal procedure.

· **Special topics in water pollution (3)**

This course will cover the principles of and ecosystem and water system in rivers, lakes and reservoirs. Special topic in water pollution and specific treatment process will be discussed.

□ Faculty Members

Bae, Doo Byong
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Lehigh Univ., Ph.D.
Structural Engineering
dbbae@kookmin.ac.kr

Cho, Nam Jun
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Cornell Univ., Ph.D.
Geotechnical Engineering
njcho@kookmin.ac.kr

Choi, Sok Hwan
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Northwestern Univ., Ph.D.
Concrete Engineering
shchoi@kookmin.ac.kr

Sohn, Jin Sik
Seoul National Univ., B.S.
Univ. of Colorado, M.S.
Univ. of Colorado, Ph.D.
Environmental Engineering
jinsiksohn@kookmin.ac.kr

Kim, Hyo Seob
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Univ. of Liverpool, Ph.D.
Coastal Engineering
hkim@kookmin.ac.kr

Kim, Dong Ha
Seoul National Univ., B.S.
Korea Advanced Institute of Science & Technology, M.S.
Kyoto Univ., Ph.D.
Environmental Engineering
kimdh@kookmin.ac.kr

Lee, Young Ki
Kookmin Univ., B.S.
Kookmin Univ., M.S.
Oregon State Univ., M.S.
Oregon State Univ., Ph.D.
Structural Engineering
leeyou@kookmin.ac.kr

Hong, Kee Jeung
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Univ. of California at Berkeley, Ph.D.
Structural Engineering
kjhong@kookmin.ac.kr

Yang, Jeong Seok
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Univ. of California at Berkeley, Ph.D.
Hydraulics and Hydrology
jyang@kookmin.ac.kr

Kim, Hyun Ki
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Georgia Institute of Technology, Ph.D.
Geotechnical Engineering
geoteen@kookmin.ac.kr

Oh, Chang Kook
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Califonia Institute of Technology, Ph.D.
Structural Engineering
ockoogi@kookmin.ac.kr

Lee, Sang Ho
Seoul National Univ., B.S.
Seoul National Univ., M.S.
Seoul National Univ., Ph.D.
Chemical Technology
sanghlee@kookmin.ac.kr