Research Areas

Structural Engineering and Materials, Geotechnical Engineering and Geosystems, Environmental Engineering and Sustainability, Urban and Architectural Planning and Design, and IT for Construction Engineering are the main research areas of the Department of Civil and Environmental Engineering at KAIST.

❒ Structural Engineering and Materials

Structural engineering combines art and science to design and build modern infrastructures that safely resist natural and man-made forces. Buildings, bridges, stadiums, offshore structures and other civil facilities define the traditional core of structural engineering. At the periphery of the field, structural engineering shares common interests with mechanical, aerospace, and naval engineering for the design of large, complex systems such as power plants, pipelines, aerospace vehicles, ships, and submarines. We have six laboratories devoted to various research activities including dynamics analysis, quantitative analysis of stresses in concrete, seismic analysis and vibration control of large structures such as bridges, buildings and nuclear power plants, and to studies on safety and reliability, structural health monitoring, and designing an effective structure system through the investigation of the nonlinear behavior of structures.

❒ Geotechnical Engineering and Geosystems

Geotechnical engineering is fundamental for construction of all type of civil structures such as large underground space and tunnel, subway and highway, railroad, port and airport structures, etc. Since geotechnical materials are ambiguous, which are not easy to determine their engineering properties, the successful geotechnical engineer must develop a 'feel' for soil and rock behavior before designing a safe and economic geotechnical structure. Three of our laboratories perform researches on the analysis, design, construction, and maintenance of earth structures related to a variety of geo-materials and subjected to various loading conditions. Our researchers are also involved in geotechnical earthquake engineering, site investigation, non-destructive testing using elastic wave propagation characteristics, and development of geophysical characterization techniques on rocks in an effort to understand the shear behavior of jointed rocks for use in large underground spaces.

❒ Environmental Engineering and Sustainability

Environmental engineering applies principles of science and engineering to find sustainable solutions to environmental problems. Environmental engineers design municipal water supply and industrial wastewater treatment systems, develop technologies for remediation of contaminated sites by spills or improper disposal of hazardous substances, and provide solutions to one of the most important issues of our modern times such as climate change, global warming, greenhouse effects, CO2 sequestration, acid rain, and stratospheric ozone depletion. Environmental engineers are also involved in research related to fossil fuel replacement by "green" resources as bioethanol and biogas. Environmental engineering education and practice is multidisciplinary by nature and requires, in addition to traditional science and engineering components, knowledge of a range of other disciplines including ecology, geochemistry, public health, economics, and computer science. Our five laboratories are actively pursuing fundamental and practical research on physicochemical and biological approaches for water, wastewater, contaminated soil, and solid waste treatment, as well as on sustainable management of environmental resources.

❒ Urban and Architectural Planning and Design (U+A+D)

The U+A+D program at CEE is one of the newly launched academic division at KAIST leveraging an array of advanced and innovative science and engineering related studies and researches being provided at KAIST. Our major focus is the integration of technology, design and business. Both urban and architectural planning and design fields are cross-disciplinary in its nature and require a comprehensive body of knowledge and practice. Thus we focus on a variety of domains ranging from urban and architectural theories, design methodology, representation and

visualization techniques, structural and ecological sustainability, human oriented design, geographic information systems, digital fabrication and rapid prototyping as well as construction management and finance.

The integrator of all our academic and professional activities is design. Using design as the vehicle for shaping of our futuristic built environment, we pursue to invent better environment for higher quality living or remodel existing buildings or cities to be upgraded to meet newly emerging civilization standards.

Our department also considers transportation engineering as a study of providing accessibility rather than the flow of people and goods as traditionally defined. The program highlights the evolution of today's transportation system including advancements in vehicle, fuel, and information technologies and the growing need for environmental sustainability. Education and research will focus on the future of the transportation system in a rapidly changing environment while understanding the wisdoms and findings that have been accumulated thus far. Specific areas of interest include the following:

- Planning and designing of transportation systems that emphasize easy and efficient accessibility in addition to fluent flow
- Adapting the system to changes and advancements in related fields including automobile design, communications, and regional and urban planning
- Understanding the interplay of transportation and policy in a society influenced by lawmakers, opinion leaders and the general public.

❒ IT for Construction Engineering

This newly founded division focuses on the development of fusion technologies between IT and civil engineering. IT-based civil engineering research fields include civil robotics, intelligent construction automation and robot, ubiquitous robotic infrastructure, and U-City management that are aimed at constructing smart and sustainable environment.

The detailed research themes are as follows:

- IT-based civil engineering that includes structural health monitoring using IT techniques and structural inspection robot, etc.
- Ubiquitous robotic infrastructure design for autonomous 3D robot navigation and U-City services
- Environmental robotics for environmental inspection, surveillance, and rehabilitation
- Intelligent construction robots using 3D environment sensing & perception, real-time HRI (Human- Robot Interaction)
- Evolutionary robotics & structural design optimization
- Soft computing (Neural networks, Evolutionary computation, Fuzzy logic) and intelligent control