New flexible undergraduate program prepares students to solve grand challenges

CHALLENGE
Solving the grand challenges in the domains of civil and environmental engineering — sustainable materials, infrastructure, transportation, and cities; and energy and the environment — will require innovative approaches that cross over traditional disciplinary boundaries. We need visionaries who can see connections among seemingly unrelated disciplines and systems, multidisciplinary teams of people whose collective synergies yield novel solutions, and highly trained individuals who can apply these solutions effectively. Each of these roles requires an educational foundation that is rigorous in the fundamentals of science and engineering, introduces pioneering tools and methodologies, fosters creativity, provides exemplary research role models, and gives ample opportunity for students to engage in hands-on research and design in both individual and team settings.

APPROACH
Beginning fall 2014, the MIT Department of Civil and Environmental will offer a new undergraduate degree program called 1-ENG (at MIT, CEE is known as Course 1). The program introduces a rigorous and creative approach to education, providing depth in the fundamentals of mathematics, chemistry, biology, physics, computation, statistics, and data analytics.

The main feature of 1-ENG is an unprecedented level of flexibility that will allow students to work closely with faculty advisors to design tracks of study that are tailored to fit a student’s needs and interests. Any track can be created by combining foundational courses with a core subject area: environmental engineering science, mechanics and materials, and systems. The environmental core introduces students to principles in environmental chemistry, microbiology, fluid mechanics, hydrology, and fieldwork. Mechanics and materials focuses on the principles of mechanics necessary to understand how materials behave at scales from the nano to the macro. Systems explores big data, system modeling and analysis, sustainability, energy systems, and transportation systems.

Sample track templates include energy; bio-inspired mechanics and mechanics for biology; systems; environmental engineering science with a focus on biology, chemistry or physics; civil engineering; structures, architecture and design; sustainable buildings and cities; and transportation. Students will take math, computation, engineering probability and statistics, data analysis, and a capstone project or thesis subject. The program offers ample opportunities to learn and apply coursework in hands-on laboratory and project-oriented subjects.

IMPACT
MIT CEE will shape students to become leaders in innovation who can create a sustainable future. 1-ENG is designed to incorporate entrepreneurial, pioneering approaches and interdisciplinary interests in undergraduate subjects. As students design their own educational track, they’ll develop a richer intellectual engagement with the curriculum and begin to find and develop their own creative research interests. All this will prepare undergraduates to attain their post-graduate goals in higher education, research, entrepreneurial activity, and the workforce.

MORE
This new educational model has the capacity to evolve to incorporate new tools and approaches as they are developed, in order to help solve the grand challenges faced by the world now and in the future.