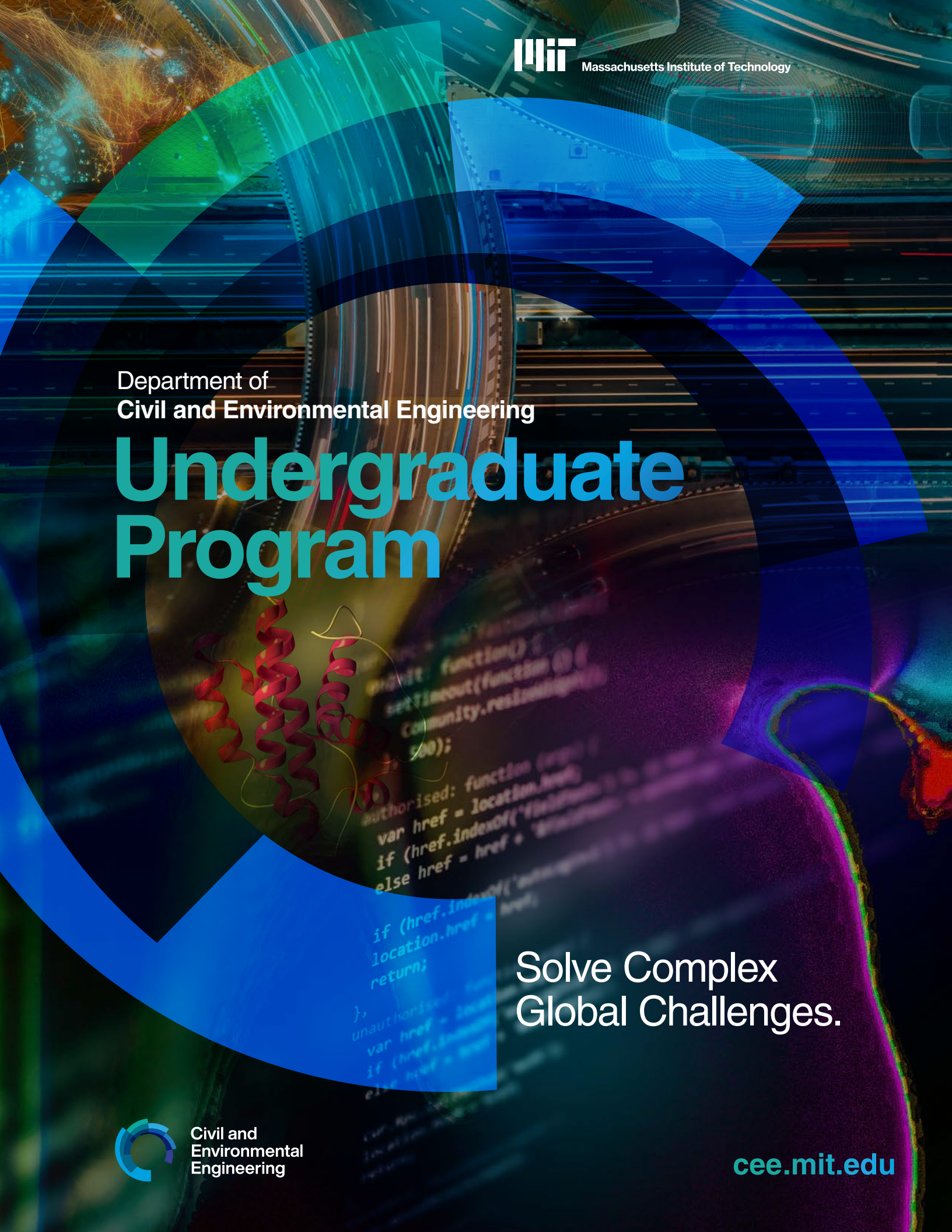
Massachusetts Institute of Technology

Department of
Civil and Environmental Engineering

Undergraduate Program



Solve Complex
Global Challenges.

Civil and
Environmental
Engineering

cee.mit.edu

ENGINEERING A SUSTAINABLE FUTURE

Course 1

Civil and environmental engineers are addressing some of the world's most complex and urgent challenges — from climate change and rapid urbanization to resource scarcity and infrastructure resilience. Their work directly improves the quality of life for communities across the globe by designing the structures we live and work in, safeguarding natural resources, building the roads we travel on, developing innovative materials, and advancing solutions to mitigate climate change.

At the heart of their efforts is a deep understanding of the human-built environment and its intricate infrastructure systems, as well as the profound effects of human activity on the natural world. By integrating scientific principles and innovative engineering design, civil and environmental engineers create transformative solutions with real-world impact — shaping a more sustainable, resilient future.

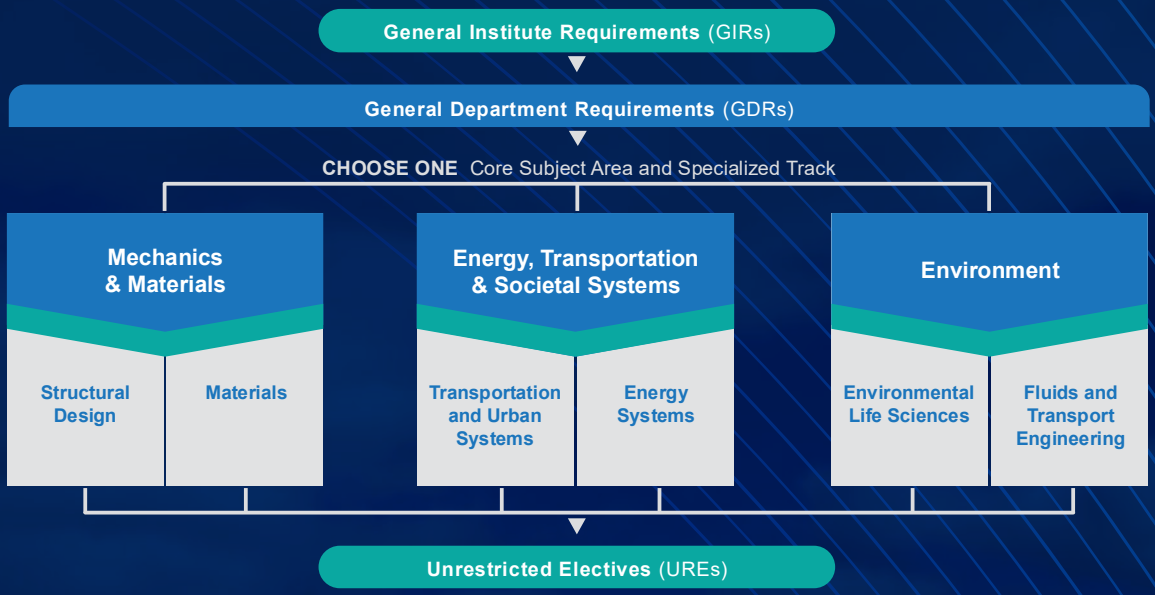
WHY CHOOSE COURSE 1-ENG AT MIT CEE?

Course 1-ENG offers a dynamic, interdisciplinary approach to engineering education. You'll integrate scientific insight, data, and engineering design to develop sustainable solutions — from understanding the behavior of materials and environmental systems to designing resilient infrastructure, clean energy and mobility networks, and healthy ecosystems.

Course 1-ENG might be a great fit if you're curious about:

- **How systems related to climate, energy, water, mobility, and materials work — and how engineering can help solve the challenges they face**
- **How natural, built, and ecological systems interact, function, and evolve over time**
- **Using data, experiments, and design to create solutions for a more sustainable and resilient future**

Course 1-ENG



Our General Engineering ABET Accredited Undergraduate Degree Consists of:

1. **General Institute Requirements (GIRs)**
2. **General Department Requirements (GDRs)**
3. **One of three Cores (each with 54-60 units)**
4. **Elective Subjects with Engineering Content (48-60 units)**
5. **Unrestricted Electives (48-54 units)**

General Department Requirements (GDRs): 54

1.000	– Computer Programming for Scientific and Engineering Applications,12 units
1.010A	– Probability: Concepts and Applications, 6 units
1.073	– Introduction to Environmental Data Analysis, 6 units
	– OR –
1.074	– Data Science Fundamentals, 6 units
18.03	– Differential Equations, 12 units
1.013	– Senior Civil and Environmental Engineering Design, 12 units, CI-M

Core subjects: 54-60

Students are required to select one area of core coursework from the following three areas: environment, mechanics and materials, or energy, transportation, and societal systems.

Elective Subjects with Engineering Content: 48-60

Students are required to take Restricted Electives selected from subjects offered within or outside CEE to form a coherent program of study under supervision by CEE faculty.

Unrestricted Electives: 48-54

To help you plan for your undergraduate career, you will select a core and work with your faculty advisor on determining a set of electives and restricted electives. The dynamic structure of the undergraduate degree program allows students to follow a set path of suggested subjects or to design a set of subjects, that combined tailor their individual educational experience. Check out more information on the cores in the following pages.

MECHANICS and MATERIALS

The Mechanics and Materials core prepares you to tackle today's infrastructure and materials challenges with a strong foundation in structural mechanics and design. You'll explore how materials behave across scales, how structures respond to stress and uncertainty, and how to create innovative, sustainable designs — with growing emphasis on climate-resilient development, decarbonizing infrastructure, and rethinking material lifecycles.

Core Subjects

- 1.035 – Mechanics of Materials, 12 units
- 1.036 – Structural Mechanics and Design, 12 units
- 1.050 – Solid Mechanics, 12 units
- 1.056 – Intro to Structural Design, 12 units
- 1.060 – Fluid Mechanics, 12 units
- 1.104 – Sensing and Intelligent Systems, 6 units, CI-M

LEARN MORE

Learn more about the mechanics and materials core here:

https://cee.mit.edu/education/undergraduate/undergraduate-degrees/

ENERGY, TRANSPORTATION, and SOCIETAL SYSTEMS (ETSS) ENGINEERING

Leverage the power of data and advanced decision-making tools to improve how we move, live, and use resources in a rapidly changing world. Choose the ETSS core to develop and apply methods from network science, optimization, control theory, and data analytics to design smarter, more resilient systems.

ETSS teaches students to analyze, optimize, and implement engineering solutions that improve the safety, efficiency, and sustainability of complex networks — including transportation, supply chains, energy, water, and other societal systems. This foundation prepares students for impactful careers in technology, consulting, infrastructure, and policy.

In addition to core CEE subjects, students explore topics in computing, robotics, machine learning, and decision sciences — equipping them with the tools to build intelligent systems for high-performance, equitable cities and infrastructure.

Core Subjects

- 1.020 – Engineering Sustainability: Analysis and Design, 12 units
- 1.022 – Intro to Network Models, 12 units
- 1.041 – Transportation: Foundations and Methods, 12 units
- 1.060 – Fluid Mechanics, 12 units

– OR –

- 1.050 – Solid Mechanics, 12 units
- 1.104 – Sensing and Intelligent Systems, 6 units, CI-M
- 15.053 – Optimization Methods in Business Analytics, 12 units

LEARN MORE

Learn more about the Energy, Transportation, and Societal Systems Engineering core here:

https://cee.mit.edu/education/undergraduate/undergraduate-degrees/

ENVIRONMENT

Help conserve and restore Earth's natural resources to improve lives and protect the planet. The Environmental Engineering Science track combines rigorous science with real-world engineering applications to understand and improve the quality of our land, water, air, and public health.

Explore innovative ways to keep air clean, ensure safe and abundant water and food, build climate-resilient communities, and safeguard human and ecosystem health. Alongside core environmental engineering subjects, students take courses in biology, chemistry, physics, data analysis, and field methods — all focused on understanding the natural world and our role within it.

By blending scientific inquiry with engineering principles, students tackle some of today's most pressing environmental challenges — from the local to the global scale.

Core Subjects

1.018	– Fundamentals of Ecology, 12 units
1.060	– Fluid Mechanics, 12 units
1.061A	– Transportation Processes in the Environment I, 6 units
1.070A	– Intro to Hydrology and Water Resources, 6 units
1.080	– Chemicals in Environment, 12 units
1.091	– Traveling Research Environmental Experience (TREX), 3 units
1.105	– Environmental Biology Lab, 6 units
1.106	– Environmental Fluid Mechanics Lab, 6 units
1.107	– Water and Air Quality, 6 units, CI-M

LEARN MORE

Learn more about the Environmental Engineering Science core here:

https://cee.mit.edu/education/undergraduate/undergraduate-degrees/

PAIR COURSE 1 with a MINOR

The Department has developed a series of major + minor degree tracks that combines together the cores within CEE (Course 1-ENG) as well as:

- **Computer Science Minor (Course 6)**
- **Design Minor (Course 4)**

Connecting the course 1-ENG degree with one of the robust minors gives CEE students a leading edge.

SMART INFRASTRUCTURE

1-ENG Core + Course 6
Computer Science Minor

A proliferation of data and networked systems are creating more efficient and sustainable alternatives for infrastructure and transportation systems. The smart infrastructure joint major + minor degree track prepares students with the skills and understanding to be leaders and developers of the future.

NETWORK SYSTEMS and COMPUTATION

1-ENG Core + Course 6
Computer Science Minor

Design and manage large scale complex systems that can be applied to a number of domains, including supply chain and logistics; infrastructure sensing and control; and societal networks, among others. The network systems and computation joint major + minor degree track prepares students with the modeling and decision-making principles required to develop and maintain successful systems.

ENVIRONMENTAL MODELING and ANALYTICS

1-ENG Core + Course 6
Computer Science Minor

Understand and model both small and large-scale ecosystems and the environment using analytical and numerical analysis. The environmental modeling analytics joint major + minor degree track prepares students with skills needed to tackle environmental challenges and to engineer solutions to major problems.

SUSTAINABLE DESIGN

1-ENG Core + Course 4
Design Minor

Understand and design both small and large scale mechanical structures using classical analyses and computational tools. The sustainable design joint major + minor develops an understanding and skills that enables students to be engineers of the future built environment.

LEARN MORE

Learn more about majoring in Course 1 and minoring in Course 6:

https://cee.mit.edu/education/undergraduate/undergraduate-minors/

EXPERIENTIAL LEARNING OPPORTUNITIES in COURSE 1

Every Course 1-ENG student is paired with a faculty advisor who helps guide course selection, Undergraduate Research Opportunities Program (UROP) planning, and career decisions.

Group Site Visits

Visit a number of nearby work sites, laboratories, and more with your fellow CEE students; The purpose of these visits is to allow our community the opportunity to see where a degree in CEE can take you.

1.097, 6 units

The mini-UROP: Intro to CEE Research

Our mini-UROP program takes place over IAP and is designed to offer freshmen a taste of the research conducted in CEE. Students will work closely with either a grad student or postdoc on a research project and have an in-depth experience in the lab over three weeks. At the end of the three weeks, mini-UROP participants present their research in "lightning" presentations to an audience of their peers and CEE community members. Many mini-UROPs have the opportunity to develop into full term UROPs in the spring. Projects range from designing a city on Mars to creating durable, eco-friendly concrete using recycled materials.

1.091, 3 units

TREX Fieldwork

Traveling Research Environmental Experiences (TREX) is a three-credit field research course offered during Independent Activities Period by the Department of Civil and Environmental Engineering to students majoring in Civil or Environmental Engineering. TREX (Course 1.091) provides CEE undergraduates with the opportunity to gain hands-on fieldwork and research experience in a global context. Past expeditions have generated enormous enthusiasm for learning about Earth systems and how to manage them sustainably.

1.103, 6 units

Infrastructure Design for Climate Change

This team-oriented, project-based subject, students work to find technical solutions that could be implemented to mitigate the effects of natural hazards related to climate change, bearing in mind that any proposed measures must be appropriate in a given region's socio-political-economic context. Students are introduced to a variety of natural hazards and possible mitigation approaches as well as principles of design, including adaptable design and design for failure. Students select the problems they want to solve and develop their projects.

1.104, 6 units

Sensing and Intelligent Systems

Students collaborate to develop a design project that involves: selecting the right kind of sensors guided by the physical principles and sensing modalities; synthesizing multi-modal data for new applications; refining commercially available sensors for new real-world applications; designing a sensor network and building data-acquisition system for use in lab experiments and/or real-world deployments; sending the data over the Internet for visualization and post-processing; and using intuition and mathematical models to analyze the data.

1.105, 6 units

Environmental Biology Laboratory

Laboratory and data analysis techniques and their application to problems in the environmental life sciences. Design and execution of experiments testing the interactive effects of environmental variables on the growth, physiology, metabolism, and reproduction of plants and microbes. Emphasis on applications in agriculture, vegetation-mediated latent heat flux, and biotechnology.

1.106, 6 units

Environmental Fluid Mechanics Laboratory

In this lab, students design and analyze experiments to understand fluid physics and mass transport processes that shape environmental systems and can be used to inform the design of nature-based solutions for environmental restoration. Emphasis is given to the design of experiments, uncertainty and propagation of error, and data analysis. Topics include diffusion, dispersion, residence time distributions, and surface waves, which are introduced in the context of designing treatment wetlands, coastal protection, and habitat restoration.

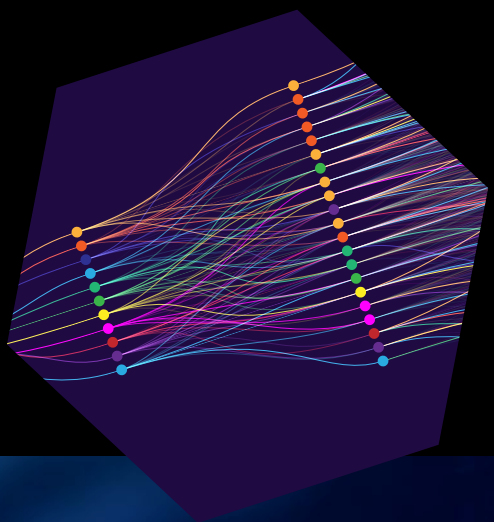
1.107, 6 units

Water and Air Quality Laboratory

Laboratory and field techniques in environmental engineering and its application to the understanding of natural and engineered ecosystems. Exercises involve data collection and analysis covering a range of topics, spanning all major domains of the environment (air, water, soils, and sediments), and using a number of modern environmental analytical techniques.

CEE Internship Program

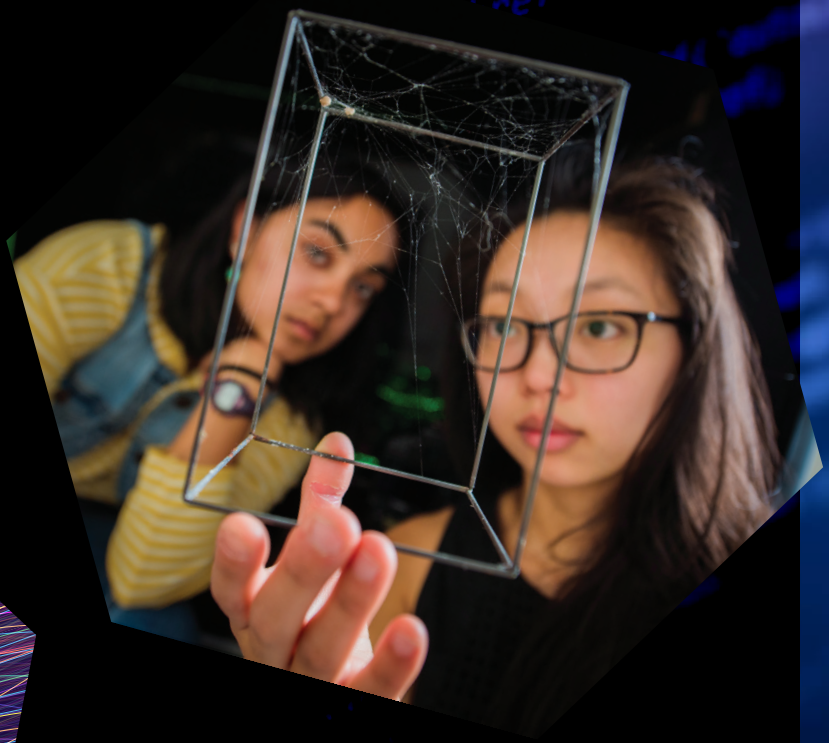
Interested in advancing your career? CEE is here to help! We will utilize alumni connections and help you take advantage of various institute and departmental resources to ensure you secure an internship that is best suited for you. Reach out to your advisor or the Academic Programs Office at cee-apo@mit.edu to set-up a time to meet!



1.034, 12 units

Materials in Human Experience (Mat-Ex)

Examines how people throughout history have selected, evaluated, processed, and utilized natural materials to create objects of material culture. Explores ideological and aesthetic criteria influential in materials development. As examples of ancient engineering and materials processing, topics may include ancient Roman concrete and prehistoric iron and steel production by the Mossi, Haya, and other African cultures. Particular attention paid to the climate issues surrounding iron and cement, and how the examination of ancient technologies can inform our understanding of sustainability in the present and illuminate paths for the future. Previous topics have included Maya use of lime plaster for frescoes, books, and architectural sculpture; the sound, color, and power of metals in Mesoamerica; and metal, cloth, and fiber technologies in the Inca empire. Laboratory sessions provide practical experience with materials discussed in class. Class trip to Pompeii and other Roman site-visits.



UNDERGRADUATE STUDENT LIFE

Course 1 students are engaged beyond the classroom. The department sponsors student groups, activities, and competitions to promote community, foster relationships, and provide opportunities to apply the skills learned in the classroom to real world problems.

CEESA

The American Society of Civil Engineers (ASCE) Student Chapter at MIT, known as CEESA (Civil and Environmental Engineering Student Association), strives to uphold the values of excellence in academic and professional environments. Through service projects, educational programs, and social functions, CEESA aims to foster a vibrant and supportive community that enables every student to reach their highest potential.

Chi Epsilon

MIT's XE chapter of the Civil Engineering Honor Society at MIT is a vibrant group of outstanding scholars who reflect the four pillars of the Civil Engineering Society, exemplifying Chi Epsilon's four pillars: Scholarship, Character, Practicality, and Sociability.

UNDERGRADUATE RESEARCH

Course 1 students have opportunities to engage in a variety of hands-on experiences that brings their coursework to life, connects them with the community, and expands their career prospects. The Undergraduate Research Opportunities Program (UROP) provides undergraduates a chance to kick-start their careers by working directly with faculty on research projects.

CAREERS in CEE

Mechanics & Materials

- **Leading Large Scale Projects**
- **Infrastructure Engineering**
- **Geomechanical Engineering**
- **Structural Engineering and Design Consulting**
- **Engineering Sustainable Materials and Structure**

Environment

- **Stormwater Management**
- **Air Quality Engineering**
- **Water Resources Engineering**
- **Conservation and Environmental Protection**
- **SustainableDevelopment**
- **Environmental Consulting**

Energy, Transportation, and Societal Systems

- **Supply Chains and Logistics**
- **Transportation Engineering**
- **Data Science and Analytics**
- **Autonomous Robotics**
- **Service Optimization**
- **Engineering Consulting**
- **Government or Corporate Research and Development**

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