Civil and Environmental Engineering

The George R. Brown School of Engineering

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Jamie Padgett
Rouzbeh Shahsavari
Ilinca Stanciulescu

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Wei Chen
Joseph Hughes
Patrick H. Moore
Charles J. Newell
Carroll Oubre
Jerome Rose
Baxter Vieux

Professors of the Practice in Civil Engineering Management:
Joseph Cibor
Edmund Segner, III

Professor in the Practice of Environmental Law
James B. Blackburn

Lecturers
Phillip deBlanc
Ross Gordon
Moyeen Haque
Charles Penland
John M. Sedlak
Nadathur Varadarajan
Steven Wilkerson

Degrees Offered: BS, BA, MCEE, MS, PhD

Civil and Environmental Engineering (CEE) is a broad and diverse field of study that offers students an education with several degree options. The most flexible degree options are at the bachelor's level, where students can major in civil engineering (BS) or civil and environmental engineering (BA) or complete a double major with any other Rice University major. One nonthesis graduate degree (MCEE) is available to students who desire additional education and specialization in civil engineering or environmental sciences and engineering. Joint MBA/Master of Engineering degrees also are available in conjunction with the Jesse H. Jones Graduate School of Management.

Students admitted for graduate study leading to MS or PhD degrees must complete a rigorous course of study that combines advanced course work with scholarly research culminating in the public defense of a written thesis. Graduate research is carried out in a range of areas reflecting the interests of the department's faculty. Examples include environmental engineering, geotechnical engineering, structural engineering and mechanics, hydrology, water resources and water quality management, air pollution and its control, and hazardous waste treatment.

BS Degree in Civil Engineering

CEE offers an innovative and challenging BS engineering curriculum that is designed to provide significant flexibility to the student. Specific details and typical course layouts by semester can be found at the departmental website: ceve.rice.edu.

The main features of the ABET accredited BS in Civil Engineering are as follows:
• Nine core courses (24 hours) primarily aimed at introduction to civil and environmental engineering, followed by 10 courses (30 hours) that represent the four thrust areas within CEE, with at least four courses from one thrust area.

• The total required CEE courses are kept to a minimum level of 54 hours to provide flexibility to the student.

• Select 12 credit hours for your focus area. Select 6 credit hours from each of the three remaining areas.

• The thrust areas include:
  1. environmental engineering (air and water quality, transport theory, modeling, and energy)
  2. hydrology and water resources (water resources and aquifer management, flood prediction, data analysis, GIS, and hydrologic modeling)
  3. structural engineering and mechanics (structural analysis, mechanics, design, and matrix methods)
  4. urban infrastructure and management (transportation systems, complex urban systems, soil mechanics, engineering economics, and management)

• A choice of free electives (6 hours) and recommended electives (9) to allow maximum flexibility for students to choose from an approved list of courses

• General science (39 hours) courses cover mathematics, physics, biology, chemistry, and earth sciences

• Distribution (24 hours) courses as per university requirements. A total of at least 132 hours are required for graduation with a BS (see detailed list below). Additional features of the BS curriculum include:
  • Freshman/sophomore year courses that introduce fundamentals of CEE primarily targeted at students with diverse science, engineering, and humanities backgrounds (CEVE 101, 211, 310, 311, 312)
  • Special-topics course available in the final year to help attract the best students to perform undergraduate research in the department.
  • Engineers Without Borders (EWB) is an important component of the program. This exciting new endeavor allows undergraduates to have an experience in a developing country where they are able to actually design and build a project to help society. Students have been attracted to the program in large numbers. (See ceve.rice.edu)

Course Requirements

General Science Requirements (* or an equivalent approved course)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAAM 210</td>
<td>Introduction to Engineering Comp</td>
<td>(3)</td>
</tr>
<tr>
<td>CAAM 335*</td>
<td>Matrix Analysis</td>
<td>(3)</td>
</tr>
<tr>
<td>CHEM 121</td>
<td>General Chemistry with Lab</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM 122</td>
<td>General Chemistry with Lab</td>
<td>(4)</td>
</tr>
<tr>
<td>BIOC 201 or ESCI 321 or ESCI 340</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>MATH 101</td>
<td>Single Variable Calculus I</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 102</td>
<td>Single Variable Calculus II</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 211</td>
<td>Ordinary Differential Equations</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 212</td>
<td>Multivariable Calculus</td>
<td>(3)</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>Mechanics with Lab</td>
<td>(3)</td>
</tr>
<tr>
<td>PHYS 102</td>
<td>Electricity and Magnetism with Lab</td>
<td>(4)</td>
</tr>
<tr>
<td>STAT 312</td>
<td>Probability and Statistics</td>
<td>(3)</td>
</tr>
</tbody>
</table>

CEE Core Requirements (24 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEVE 101 (F)</td>
<td>Fundamentals of CEE</td>
<td>(3)</td>
</tr>
<tr>
<td>CEVE 211 (F)</td>
<td>Engineering Mechanics</td>
<td>(3)</td>
</tr>
<tr>
<td>CEVE 310 (F)</td>
<td>Principles of Environmental</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>CEVE 311 (S)</td>
<td>Mechanics of Solids and</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>Structures</td>
<td></td>
</tr>
<tr>
<td>CEVE 312 (S)</td>
<td>Strength of Materials Lab</td>
<td>(1)</td>
</tr>
<tr>
<td>CEVE 363 (F)</td>
<td>Fluid Mechanics</td>
<td>(3)</td>
</tr>
<tr>
<td>CEVE 401 (F)</td>
<td>Environmental Chemistry and Lab</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEVE 480 (S)</td>
<td>Senior Design Project</td>
<td>(3)</td>
</tr>
<tr>
<td>CEVE 481(F)</td>
<td>Introduction to Senior Design</td>
<td>(1)</td>
</tr>
</tbody>
</table>
**Area I Environmental Engineering (select six approved hours)**

CEVE 302 (F) Sustainable Design (3)
CEVE 307 (S) Energy and the Environment (3)
CEVE 308 (F) Air Pollution Control (3)
CEVE 404 (S) Atmospheric Particulate Matter (3)*
CEVE 406 (S) Environmental Law (3)*
CEVE 411 (F) Atmospheric Processes (3)
CEVE 434/534 (F) Fate and Transport of Contaminants in the Environment (3)
Or any approved environmental course in CEE

**Area II Hydrology and Water Resources (select six approved hours)**

CEVE 412 (S) Hydrology and Watershed Analysis (3)
CEVE 415/515 (F) Water Resources Engineering and Planning* (3)
CEVE 418 (F) Quantitative Hydrogeology (3)
CEVE 450 (S) Remote Sensing (3)
CEVE 451 (F) Analysis of Environmental Data (3)
CEVE 453 (F) Geographical Information Science (3)
CEVE 512 (S) Hydrologic Design Lab (3)
Or any approved course in CEE

**Area III Structural Engineering and Mechanics (select six approved hours)**

CEVE 304 (S) Structural Analysis (3)
CEVE 400 (S) Advanced Mechanics of Materials (3)
CEVE 405 (S) Steel Design (3)
CEVE 407 (F) Reinforced Concrete Design (3)
CEVE 408 (F) Structures Lab (1)
CEVE 427 (F) Matrix Methods in Structural Mechanics (3)
CEVE 476 (S) Structural Dynamic Systems (3)*
Or any approved structures/mechanics course in CEE/MECH

**Area IV Urban Infrastructure and Management (select six approved hours)**

CEVE 313 (S) Uncertainty and Risk Assessment (3)
CEVE 322 (S) Engineering Economics (3)
CEVE 452 (S) Urban Transportation Systems (3)
CEVE 460/560 (F) Bridge Engineering and Extreme Events* (3)
CEVE 470 (F) Basic Soil Mechanics (4)
CEVE 479/505 (F) Engineering Project Management (3)
CEVE 492 (F) Complex Urban Systems (3)
Or any approved urban infrastructure and management course in CEE/MBMT/ECON/CAM/STAT

**List of CEE Recommended Elective Courses:**

CEVE 302, 306, 314, 320, 404, 417, 454, 490, 495, 499
(others listed on website)

*Offered alternative years

**ABET Program Objectives**

(See website at ceve.rice.edu/ for additional information.)

1. Develop/demonstrate strong problem-solving and communication skills
2. Achieve leadership position in technical or managerial area
3. Demonstrate initiative and innovative thinking in project work
4. Maintain a keen awareness of ethical, social, environmental, and global concerns
5. Remain engaged in continuing learning, including advanced degrees
6. Prepare for a Professional Engineering License

ABET, Inc. III Market Place, Suite 1050
Baltimore, MD 21202-4012
Phone: 410-347-7700
Email: eac@abet.org
Website: http://www.abet.org

**BA degree in Civil and Environmental Engineering**

The BA degree in Civil and Environmental Engineering is designed to provide access to topics of common interest to students across the disciplines at Rice University, with an emphasis on either Environmental (Track E) or Civil (Track C) Engineering. Each Track is to be tailored to the specific needs of each student by discussions with, and approval by, the CEE departmental advisor.
An advisor will be assigned by the CEE department chair, normally during the first year of study. Five core courses in each Track plus seven courses in a focused specialty area of study are required (see below for example areas); total CEE requirements equal approximately 37 hours. In addition, each student is responsible for satisfying the university distribution requirements (24 hours) and additional electives for a total of 120 hours for graduation with a BA in Civil and Environmental Engineering. Although not required, students are encouraged to double major in their focus specialty area.

The coherent and complete core curriculum is designed to give Rice undergraduate students a consistent technological literacy through the lens of Civil and Environmental Engineering and to prepare students for graduate school in engineering, various sciences (depending upon focus), economics, business MBA, political science, law, or medicine. Select students will be invited to finish an accelerated MS/PhD degree in the CEE Department (talk with your advisor or department chair for details). Those students who want to obtain an ABET accredited engineering degree must follow a BS degree program in one of the engineering disciplines, including Civil Engineering.

A student must demonstrate proficiency in the basic concepts of mathematics, computation, chemistry, and physics. Generally, this will require that these subjects were studied previously; e.g., AP exams, or concurrent enrollment with CEVE 101, 307, or 211.

**BA Degree in Civil and Environmental Engineering**

**Track C**: Civil Core Curriculum

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEVE 101</td>
<td>Fundamentals of Civil and Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 211</td>
<td>Engineering Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 310</td>
<td>Principles of Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 311+312</td>
<td>Mechanics of Solids and Structures plus laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CEVE 363</td>
<td>Applied Fluid Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 16

**Track E**: Environmental Core Curriculum

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEVE 101</td>
<td>Fundamentals of Civil and Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 307</td>
<td>Energy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 310</td>
<td>Principles of Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEVE 401</td>
<td>Chemistry for Environmental Engineering and Sciences</td>
<td>4</td>
</tr>
<tr>
<td>CEVE 412</td>
<td>Hydrology and Watershed Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 16

*Students taking the Civil Core Curriculum, Track C, should check the General Announcements for specific prerequisites in MATH, COMP and CAAM.

Seven (7) courses from approved electives must include 4 courses from 1 specific focus area; 4 of these 7 courses must be 300 level or above, and 2 of these upper-division courses must be from the CEE curriculum.

Example focus speciality areas might include the following. These are only example focus areas; students are encouraged to prepare their own related to their career objectives in consultation with, and approval by, their CEE faculty advisor.


Engineers Without Borders (EWB) is an important component of the CEE program. This exciting new endeavor allows undergraduates to have an experience in a developing country, where they are able to actually design and build a project to help society. Students have been attracted to the EWB program in large numbers and the local chapter is one of the most successful in America.
**Degree Requirements for MCEE, MS, and PhD**

**Admission**—Applicants pursuing graduate education in environmental engineering or hydrology should have a BS or BA in related areas of science and engineering and preparation in mathematics, science, and engineering or related courses. A BS degree in Engineering or a degree in natural science is preferred. Applicants pursuing graduate education in structural engineering, structural mechanics, and geotechnical engineering should have a BS in Civil Engineering with a significant emphasis on structural engineering, but students with other undergraduate degrees may apply if they have adequate preparation in mathematics, mechanics, and structural analysis and design. Successful applicants typically have at least a 3.00 (B) grade point average in undergraduate work and high Graduate Record Examination (GRE) scores. For general university requirements, see Graduate Degrees and Admission to Graduate Study (Graduate Student section, pages 3–4).

**MS Program**—The Master of Science degree is offered in both civil engineering and environmental engineering. For general university requirements, see Graduate Degrees (Graduate Student section, pages 3–4). To earn a MS degree, students must:

- Complete at least 24 semester hours of approved courses. For students studying environmental engineering, this must include one course each in environmental chemistry, water treatment, hydrology, and air quality. For students studying civil, structural engineering, and mechanics, this must include one course each in structural engineering, mechanics, advanced mathematics, and dynamic systems (comparable course work completed previously may be substituted for the core courses).
- Select a thesis committee according to department requirements and conduct original research in consultation with the committee.
- Present and defend in oral examination an approved research thesis.

Students take the oral exam only after the committee determines the thesis to be in a written format acceptable for public defense. Normally, students take two academic years and the intervening summer to complete the degree.

Students intending to extend their studies into the PhD degree program should note that the department does not grant an automatic MS degree to candidates who have not written a satisfactory master's thesis.

**MBA/MCEE Program**—For general university requirements, see Graduate Degrees (Graduate Student section, pages 3–4). See also Management and Accounting (in Departments & Programs section). To earn a MBA/MCEE degree, students must:

- Complete 24 semester hours of civil engineering courses.
- Complete 52 semester hours of business administration courses.

**MCEE Program**—The Master of Civil and Environmental Engineering (MCEE) is a professional nonthesis degree requiring 30 semester hours of approved course work. Students who have a BS or BA degree in any field of engineering or related study may apply (see Graduate Degrees in Graduate Students section, pages 3–4). Depending on their background, some students may need to fulfill prerequisites or take remedial engineering courses to earn the MCEE degree. Refer to our website, www.ceve.rice.edu.
PhD Program—To earn a PhD degree, candidates must spend at least four semesters in full time study at Rice and successfully accomplish the following. (See candidacy, oral examinations, and the thesis in Graduate Students section, pages 13–15).

- Complete 90 semester hours of approved credits past BS (60 semester hours past MS) with high standing (See guidelines on our website, www.ceve.rice.edu.)
- Pass a preliminary examination in civil and environmental engineering (see guidelines on our website, www.ceve.rice.edu.)
- Pass a qualifying examination on course work, proposed research, and related topics
- Complete a dissertation indicating an ability to do original and scholarly research
- Pass a formal public oral examination on the thesis and related topics. PhD students take the preliminary exam, administered by department faculty, after two semesters of course work. Students who pass this exam then form a doctoral committee according to department requirements. The qualifying examination is administered by the doctoral committee after students develop a research proposal to demonstrate their preparation for the proposed research and identify any areas requiring additional course work or study. As part of the advanced degree training, we also may require students to assist the faculty in undergraduate courses and laboratory instructions.