



# Environmental Engineering

UNIVERSITY OF COLORADO **BOULDER**

## ***Environmental Engineering (EVEN) B.S. Degree Guidelines***

**Academic Year 2017-2018**

**College of Engineering and Applied Science**

**University of Colorado at Boulder**

### **Environmental Engineering Program**

1111 Engineering Drive, Engineering Center  
428 UCB

University of Colorado  
Boulder, Colorado 80309-0428  
[www.colorado.edu/even](http://www.colorado.edu/even)

### **Environmental Engineering Program Staff**

Director: Professor R. Scott Summers, ECST 203, 303.492.6644,  
R.Summers@colorado.edu

Undergraduate Academic Advisor: Joanne Uleau, ECST 201, 303.735.0253  
Joanne.Uleau@colorado.edu

Program Assistant / Webdesign: Laurence Lambert, ECST 202, 303.492.2067  
Laurence.Lambert@colorado.edu

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Latest and previous versions at <http://www.colorado.edu/even/current-students/guidelines>

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# 1. Overview of Guidelines and Introduction to Environmental Engineering

The Environmental Engineering BS Degree Guidelines provide an outline of the curriculum and policies of the Environmental Engineering (EVEN) BS degree offered by the College of Engineering and Applied Science of the University of Colorado at Boulder. These guidelines are written primarily for students and Faculty Advisors of the EVEN Program. The current version of these Guidelines and versions dating back to the beginning of the Program in 1998 are kept on the Program's web site ([www.colorado.edu/even/current-students/guidelines](http://www.colorado.edu/even/current-students/guidelines)).

General policy information for students is also available from the Office of Student Services in the Dean's Office of the College of Engineering and Applied Science (<http://www.colorado.edu/engineering/academics/policies>) and in the University of Colorado at Boulder Catalog ([www.colorado.edu/catalog/](http://www.colorado.edu/catalog/)). Further information on academic support programs, is available at <http://www.colorado.edu/engineering/academics/support>.

Information on courses offered, including course descriptions, is available in the University Catalog. The course schedule for each semester is available to CU students through the MyCUInfo portal ([mycuinfo.colorado.edu](http://mycuinfo.colorado.edu)). A .pdf file of course listings, alphabetical by college and department, can be found on the Continuing Education Access site: [conted.colorado.edu/programs/access/](http://conted.colorado.edu/programs/access/) (This document is not updated past its "publication date" so check the online schedule for the most recent information.)

## 1.1. Overview of Environmental Engineering

Environmental engineers play a vital role in maintaining the quality of both human environmental systems and the natural environment. Environmental engineering encompasses the scientific assessment and development of engineering solutions to environmental problems impacting the biosphere, land, water, and air quality. Environmental issues affect almost all commercial and industrial sectors, and are a central concern for the public, for all levels of government, and in international relations. These issues include safe drinking water, wastewater processing, solid and hazardous waste disposal, outdoor air pollution, indoor air pollution, transfer of infectious diseases, human health and ecological risk management, prevention of pollution through product or process design, and renewable and sustainable energy sources and their effects on the environment.

To address these challenges, environmental engineers often encounter challenging problems that must be solved in data-poor situations as members of multidisciplinary teams. Environmental problems require creative solutions with contributions from scientists, lawyers, business people, and the public. Good communication skills, as well as technical proficiency, are essential for success in this arena. In addition, technology designed to address environmental problems is marketed globally, opening up increasing opportunities for international work in the environmental engineering field.

## 1.2. History of the Environmental Engineering Program

The Environmental Engineering Program at the University of Colorado at Boulder originated with a college-wide faculty committee that met during the 1993-1994 academic year to develop a multi-disciplinary curriculum for a Bachelor of Science degree in Environmental Engineering. The degree program was intended to supplement environmental engineering options that were offered through the Departments of Chemical and Biological Engineering (ChBE) and Civil, Environmental, and Architectural Engineering (CEAE) and the Department of Mechanical Engineering (ME). The initiative to develop the EVEN BS degree and the Environmental Engineering Program to administer the degree was motivated by recognition that (1) environmental engineering had matured into a full-fledged discipline of its own and (2) environmental engineering intersected with the traditional disciplines of chemical, civil, and mechanical engineering, but was not adequately covered by any single discipline. The faculty committee decided that students intending to work in environmental engineering would benefit from a curriculum that focused on environmental engineering and related courses regardless of which department offered those courses. At the same time, the existing environmental engineering options could be retained in the departments for students who were interested in environmental engineering but wanted to pursue traditional chemical, civil, or mechanical engineering degrees.

The proposed EVEN BS degree program was approved by the faculty of the College of Engineering and Applied Science in the spring of 1994. The faculty committee then prepared a full proposal for the new degree program for the Colorado Commission on Higher Education (CCHHE), and the new EVEN BS degree program was approved in the spring of 1998. Students began entering the program in the fall of 1998. The first degree was awarded in December 1999 (to a student who transferred into the program as a third-year student), and the first class graduated in June 2002.



The Engineering Center at the University of Colorado at Boulder.

In approving the new degree, CCHE relied on the College's intent to deliver the EVEN BS degree using existing courses and faculty. While the program is administered by the CEAE Department it operates independently through the participation of faculty from Civil, Environmental, and Architectural Engineering, Mechanical Engineering, Chemical and Biological Engineering, and Aerospace Engineering Sciences Departments. The College provides support for a faculty director, two instructors, an academic advisor and administrative support, and teaching support for courses to supplement the EVEN curriculum. The departments that participate in the program are committed to regularly offering the courses that comprise the EVEN curriculum, coordinating to avoid scheduling conflicts, and sharing academic advising and other faculty service requirements. Professors Jana Milford (ME), Angela Bielefeldt (CEAE), Joseph Ryan (CEAE) and R. Scott Summers (CEAE) have served as Environmental Engineering Program Director.

During the 2002-2003 academic year, the Environmental Engineering Program applied for accreditation of the EVEN BS degree with the Engineering Accreditation Commission of ABET (Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org)). The ABET examiners were thoroughly satisfied with the EVEN BS degree and the Engineering Accreditation Commission of ABET granted accreditation to the degree in September 2003. The Environmental Engineering Program completed the first major revision of the EVEN curriculum for the 2004-2005 academic year, and was re-accredited in 2006 and 2012.



EVEN students on a field trip for the CVEN 3434 Introduction to Applied Ecology course with Professor Diane McKnight.

### 1.3. Mission and Educational Objectives

The EVEN faculty, its Professional Advisory Board (representing prospective employers of our graduates), and EVEN alumni and current students have contributed to the creation of the Program's mission and the educational objectives of the EVEN BS degree.

The **mission** of the Environmental Engineering Program is to provide a multidisciplinary undergraduate environmental engineering education that emphasizes mastery of principles and practices, inspires service for the global public good, endows a desire for life-long learning, and prepares students for broad and dynamic career paths in environmental engineering.

The objective of the Environmental Engineering (EVEN) Bachelor of Science Degree is to produce graduates who are capable of reaching the following career goals three to five years after graduation

1. Graduates will be employed in engineering, science or other professional careers
2. Graduates will pursue professional registration or other appropriate certifications
3. Graduates will be engaged in continual learning by pursuing advanced degrees or additional educational opportunities through coursework, professional conferences and training, and/or participation in professional societies.
4. Graduates will be engaged in activities that provide benefits to communities, the environment, and/or public health.

### 1.4. Program Outcomes

A list of program outcomes for EVEN graduates was developed that satisfies the requirements of ABET in the Criteria for Accrediting Engineering Programs for general engineering programs (ABET Criterion 3) and for environmental engineering programs as developed by the American Academy of Environmental Engineers (AAEE) and cooperating societies. As defined by ABET, outcomes are "statements that describe what students are expected to know and are able to do by the time of graduation" (ABET, 2010).<sup>1</sup>

<sup>1</sup> ABET Engineering Accreditation Commission, Criteria for Accrediting Engineering Programs: Effective for Evaluations During the 2011-2012 Accreditation Cycle, Baltimore, MD, 2010.

The outcomes that students are expected to have attained upon graduation with a Bachelor of Science degree in environmental engineering are:

|  |                 |
|--|-----------------|
| <ul style="list-style-type: none"> <li>• the ability to apply knowledge of math, science and engineering</li> <li>• the ability to design and conduct experiments</li> <li>• the ability to analyze and interpret data</li> <li>• the ability to design a system, component or process to meet desired needs within realistic constraints</li> <li>• the ability to function on multidisciplinary teams</li> <li>• the ability to identify, formulate and solve engineering problems</li> <li>• an understanding of professional and ethical responsibility</li> <li>• the ability to communicate effectively through writing</li> <li>• the ability to communicate effectively through oral presentations</li> <li>• an understanding of the impact of engineering on society</li> <li>• a recognition of the need for and an ability to engage in life-long learning</li> <li>• a knowledge of contemporary issues in environmental engineering</li> <li>• the ability to use modern engineering techniques, skills and tools</li> </ul> | <b>Outcomes</b> |
|--|-----------------|

The curriculum that has been developed and the content of those courses help to ensure that the Environmental Engineering Program satisfies these outcome goals. Extracurricular activities, internships, co-ops and participation in research also contribute to satisfying these goals. Evaluation of courses and surveys of graduating seniors and alumni help us to document that the EVEN Program successfully achieves these outcomes. Student performance on the Fundamentals of Engineering (FE) exam also documents our success. Review of course syllabi and student work by faculty and the Advisory Board ensures on-going evaluation and improvement of our curriculum to best serve our students and the Environmental Engineering profession.

## 2. Environmental Engineering Degree Programs

### 2.1. Bachelor of Science Degree in Environmental Engineering

#### 2.1.1. Overview of EVEN BS Degree

The Bachelor of Science degree in Environmental Engineering at the University of Colorado provides preparation for professional proficiency or graduate training in environmental engineering in a four-year curriculum.

The curriculum includes courses in engineering fundamentals and applications, advanced mathematics, chemistry, physics, biology, and earth science, as well as the arts, humanities and social sciences. Courses specific to environmental engineering practice include water chemistry, microbiology, and air pollution control. In addition, environmental engineering requires hands-on laboratory experiences, up-to-date skills in the use of computers for modeling and data analysis, and experience in the design of environmental engineering systems. Many of the required engineering courses in the Bachelor of Science curriculum are delivered by the departments of Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering. The curriculum includes three technical elective courses and a free elective. The curriculum specifies two courses of environmental engineering design and three environmental engineering technical elective courses. A student can use these three upper-division courses to develop an area of specialization in environmental engineering beginning in the third year. However, a student can also chose to take courses that cross-cut a breadth of environmental engineering topics as discussed in section 2.2.

The faculty have developed a list of suggested courses in seven areas of specialization:

|  |                                |
|--|--------------------------------|
| Air Quality                            | Energy Conversion Fundamentals |
| Environmental Remediation              | Applied Ecology                |
| Chemical Processing                    | Water Resources and Treatment  |
| Engineering for Developing Communities |                                |

Students in the program are also encouraged to participate in research through independent study projects, a senior thesis, the Undergraduate Research Opportunities Program (UROP), the Discovery Learning Apprenticeship Program ([www.colorado.edu/activelearningprogram/discovery-learning](http://www.colorado.edu/activelearningprogram/discovery-learning)), or as undergraduate research assistants in sponsored research programs.

## 2.1.2. Curriculum for EVEN BS Degree

The following section contains the curriculum for the EVEN BS degree. The curriculum represents a “contract” of sorts with incoming students – for students entering the program during the current academic year, completion of this curriculum with a satisfactory grade point average is the requirement for graduation. The curriculum also represents a guarantee that the courses listed (or approved substitutes) will be available in the semesters listed.

The curriculum is somewhat dynamic despite its contractual nature. Minor changes may be made by the Program during the academic year, and major changes may be made between academic years. To meet graduation requirements, students are expected to follow the curriculum in effect for the academic year that they matriculated into the program; therefore, students should keep a copy of the Environmental Engineering (EVEN) Degree Guidelines for that year. An archive of the Guidelines is retained on the program’s web site ([www.colorado.edu/even/current-students/guidelines](http://www.colorado.edu/even/current-students/guidelines)).

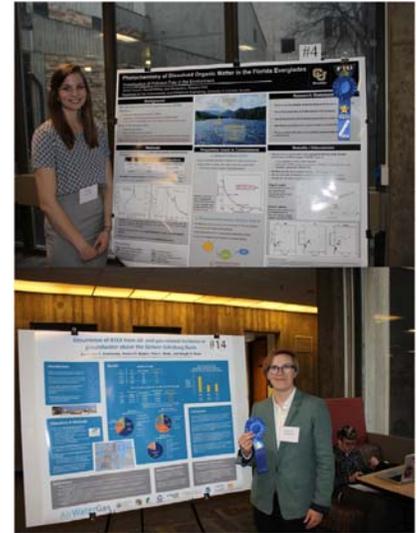
Students may elect to follow a later curriculum revision with program approval; however, students may not elect to follow a curriculum in effect before they started the program, and may not combine curricula for different years.

The curriculum below shows the recommended sequence of courses. Courses marked with an asterisk (\*) are offered only in the semester shown (fall or spring). Other courses are offered in both semesters, and sometimes in the summer. Students may take courses in terms other than those shown, but must be careful to meet prerequisites or co-requisites for each course. The air or earth sciences lab or field course and the free elective (both listed in the fourth year) may be taken in any semester.

Many of the required courses in the EVEN BS curriculum (solid mechanics, engineering economics, fluid mechanics, thermodynamics, heat transfer, probability and statistics) may be satisfied by courses from various engineering departments. Students may choose a course from any of the approved courses for each requirement; however, students should evaluate these choices carefully depending on their major interest in environmental engineering. For example, a student interested in an air quality specialization would want to take the Mechanical Engineering courses for solid mechanics, fluid mechanics, thermodynamics, and heat transfer, while a student interested in a chemical processing specialization would choose chemical engineering courses.

For certain courses in the EVEN BS degree curriculum, students may encounter questions about prerequisite and co-requisite course requirements not being met. If students are following the recommended curriculum sequence there is no need for concern; the Environmental Engineering Program has consulted in detail with the departments and faculty offering these courses to ensure that the sequence of courses in the EVEN curriculum is appropriate for engineering students.

Guidance on selection of Humanities and Social Science (H&SS) and technical elective courses is offered in Section 4.



Jenna Crouch and Katherine Armstrong - 2016 Discovery Learning Research Symposium Awardees

# ENVIRONMENTAL ENGINEERING (EVEN) B.S. DEGREE Curriculum

2017-2018 Academic Year

| Fall, First Year  |           | Spring, First Year   |           |
|---|-----------|--|-----------|
| APPM 1350 Calculus 1 for Engineers  | 4         | APPM 1360 Calculus 2 for Engineers                               | 4         |
| CHEM 1211 General Chemistry for Engineers                                     | 4         | CHEM 1310 Intro to Engineering Computing                         | 3         |
| CHEM 1221 General Chemistry Laboratory  | 1         | PHYS 1110 General Physics 1                                      | 4         |
| EVEN 1000 Introduction to Environmental Engineering (*)                       | 1         | Technical Elective I <sup>2</sup>                                | 3         |
| GEEN 1400 Engineering Projects  | 3         | H&SS Elective II <sup>3</sup>                                    | 3         |
| H&SS Elective I <sup>3</sup>  | 3         |  |           |
|   | <b>16</b> |  | <b>17</b> |
| Fall, Second Year   |           | Spring, Second Year  |           |
| APPM 2350 Calculus 3 for Engineers  | 4         | APPM 2360 Intro Differential Eq with Linear Algebra              | 4         |
| PHYS 1120 General Physics 2   | 4         | Fluid Mechanics <sup>5</sup>                                     | 3         |
| PHYS 1140 Experimental Physics 1  | 1         | CHEM 2120 Material and Energy Balances                           | 3         |
| Solid Mechanics <sup>4</sup>  | 3         | CVEN 3414 Fundamentals of Environmental Engineering              | 3         |
| H&SS Elective III <sup>3</sup>  | 3         | H&SS Elective IV <sup>3</sup>                                    | 3         |
|   | <b>15</b> |  | <b>16</b> |
| Fall, Third Year  |           | Spring, Third Year   |           |
| EVEN 4404 Water Chemistry (*)   | 3         | EVEN 4484 Introduction to Environmental Microbiology (*)         | 3         |
| EVEN 4414 Water Chemistry Lab (*)   | 1         | EVEN 4424 Environmental Organic Chemistry (*)                    | 3         |
| EVEN 3550 Sustainability Principles for Engineers (*)                         | 3         | Heat Transfer <sup>6</sup>                                       | 3         |
| Thermodynamics <sup>7</sup>   | 3         | Probability and Statistics <sup>8</sup>                          | 3         |
| Engineering Economics <sup>13</sup>   | 3         | Environmental Engineering TE Sequence I <sup>9</sup>             | 3         |
| Required Writing Course <sup>10</sup>   | 3         |  |           |
|   | <b>16</b> |  | <b>15</b> |
| Fall, Fourth Year   |           | Spring, Fourth Year  |           |
| EVEN 4464 Environmental Engineering Processes (*)                             | 3         | CVEN 4333 Engineering Hydrology (*)                              | 3         |
| H&SS Elective V <sup>3</sup>  | 3         | MCEN 4131 Air Pollution Control (*)                              | 3         |
| Free Elective   | 2         | EVEN 4434 Environmental Engineering Design (*)                   | 4         |
| Environmental Engineering TE Sequence II <sup>9</sup>                         | 3         | Environmental Engineering TE Sequence III <sup>9</sup> or        |           |
| Air or Earth Science Laboratory/Field   | 3         | Technical Elective II <sup>2</sup>                               | 3         |
| Technical Elective II <sup>2</sup> /Senior Thesis <sup>11</sup> or Option III | 3         | Technical Elective III <sup>2</sup> /Senior Thesis <sup>12</sup> | 3         |
|   | <b>17</b> |  | <b>16</b> |

\* Only offered in the semester shown (not including summer offerings).

**Total Credit Hours 128**

<sup>2</sup>A total of 9 credit hours of technical electives is required, from engineering, mathematics or sciences. Three TE credits may be lower division (1000-, 2000-level); remaining TE credits must be upper division (3000+). Three TE credits must be in the earth sciences, either lower or upper division. An independent study or senior thesis may be completed as technical electives for up to 6 credits.

<sup>3</sup>A total of 15 credit hours of humanities and social sciences (H&SS) electives is required. At least six hours must be at the upper division level.

<sup>4</sup>Solid Mechanics options: CVEN 2121 Analytical Mechanics (F,S), GEEN 2851 Statics for Engineers, or MCEN 2023 Statics and Structures (F)

<sup>5</sup>Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics (S, required for Chemical Processing Option), CVEN 3313 Theoretical Fluid Mechanics (S), GEEN 3853 Fluid Mechanics for Engineers (Sum), or MCEN 3021 Fluid Mechanics (F,S)

<sup>6</sup>Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer (F) or MCEN 3022 Heat Transfer (F,S)

<sup>7</sup>Thermodynamics options: AREN 2110 Thermodynamics (F,S), CHEN 3320 Chemical Engineering Thermodynamics (F; required for Chemical Processing Option), GEEN 3852 Thermodynamics for Engineers (Sum), or MCEN 3012 Thermodynamics (F, S, required for Air Quality Option)

<sup>8</sup>Probability and Statistics options: APPM 4570 Statistical Methods (F,S), CHEN 3010 Applied Data Analysis (F), CVEN 3227 Probability, Statistics, and Decision (S)

<sup>9</sup>Environmental Engineering TE courses are specified on the following pages.

<sup>10</sup>Writing: HUEN 1010 Intro to the Humanities Freshman only (F,S), HUEN 3100 Humanities for Engineers 1 (F,S), PHYS 3050 Writing in Physics: Problem Solving & Rhetoric (F), WRTG 3030 Writing on Science and Society (F,S,Sum), or WRTG 3035 Technical Communication and Design (F, S).

<sup>11</sup>Senior Thesis: a senior thesis can be completed on a single research topic, with faculty approval and direction, and can apply toward technical elective requirements.

<sup>13</sup>Engineering Economics options: CVEN 4147 Civil Engineering Systems (F), EMEN 4100 Business Methods and Economics for Engineers, CVEN 3246 Introduction to Construction (F,S, Sum).

## 2.2. EVEN Sequence: Design and Technical Electives (new beginning 2016-2017)

Beginning in the spring semester of their third year, EVEN students begin a three course (nine (9) credit hours) sequence in environmental engineering. They will take one 3-credit "environmental engineering design" course from those in list A and two additional (6-credits) "environmental engineering upper-division technical elective" courses from list B (or a second from list A, no double counting).

**Note** that not all of the courses listed are offered every year, denoted by \*I

**List A – Environmental Engineering Design Electives** - at least one course from this list (faculty can petition to add additional courses)

Per ABET Engineering Accreditation Criteria, "Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs."

**CVEN 3424 Water and Wastewater Treatment** (pre-req CVEN 3414, Spring) Introduces design and operation of facilities for treatment of municipal water supplies and wastewater. Involves an integrated design of whole treatment systems combining process elements

**CVEN 4474 Hazardous Waste Management** (pre-req CVEN 3414, intermittent) Requires team design project for site remediation, including alternatives assessment; about 20% of course grade based on that project

**CVEN 3323 Hydraulic Engineering** (pre-req fluids, Fall) Topics include incompressible flow in conduits, pipe system analysis and design, open channel flow, flow measurement, analysis and design of hydraulic machinery [course also includes a lab component]

**CVEN 4323 Water Resource Engineering Design** (juniors/seniors, Fall) Studies principles and techniques of water resources engineering design. Introduces environmental modeling under uncertainty, stormwater design, precipitation estimation, and flow routing

**MCEN 3032 Thermodynamics 2** (junior/senior; pre-req MCEN 3012 Thermo and MCEN 3021 Fluids, Fall and Spring) Offers advanced topics and applications, including thermodynamics of state, entropy and probability, thermodynamic cycles, and reacting and nonreacting mixtures. Provides application to engines and power generation by conventional and alternative energy technologies. Most assignments are design oriented.

**ENEN 4600 Energy Engineering Projects** (3) (offered fall semester only, prereqs: ENVS 3621 and CHEN 3660 (C grade needed). Restricted to ENMR-MIN. Prepares students to analyze energy systems from technical, economic, and policy perspectives, with project topics varying by semester. Provides historical and contemporary context of the energy landscape. Emphasizes application of engineering fundamentals for the design and evaluation of real world energy systems. Projects will be completed in interdisciplinary teams.

**CHEN 3220 Chemical Engineering Separations and Mass Transfer** (prereqs: CHEN 3200 and CHEN 3320, Spring) Studies separation methods including distillation, absorption, and extraction, and graphical and computer-based solutions to separation problems. Applies mass transfer rate theory to packed and tray columns.

**List B Environmental Engineering Technical Electives (upper-division)**- at least two courses from this list (or a second from list A, no double counting). Faculty can petition to add additional courses:

Students are encouraged to select courses that meet their career goals and interests. This may include courses within a similar theme, or cross-cut a breadth of environmental engineering topics. As such, this list is organized under various specialization topics within environmental engineering. Environmental engineering design courses from List A also fit under these various specialization topics.

It can be critical that early in the curriculum that students pay careful attention to pre-requisites for these technical electives, as discussed in section 2.1.2. All courses that are numbered 5000 or above are graduate level courses and can only be taken with instructor permission; students should consult carefully with their advisor before selecting a graduate level course. Graduate level courses are good options for double-counting for students admitted to the BS/MS program.

### **<sup>1</sup> Also on List A**

#### Air Quality

ATOC 3500/CHEM 3151 Air Chemistry and Pollution (3 credits, S; prerequisites: two semesters chemistry)

ATOC 4720 Introduction to Atmospheric Physics and Dynamics (3 credits, F; prerequisites: APPM 1350, PHYS 1110)

CVEN 4554 Fundamentals of Air Quality Management (3 credits, F prerequisites: APPM 2360, fluid mechanics)

**1**MCEN 3032 Thermodynamics 2 (3 credits, F&S; prerequisites: thermodynamics and fluid mechanics)

MCEN 4141 Indoor Air Pollution (3 credits, I\*; prerequisites: fluid mechanics, heat transfer)

MCEN 4057 Environmental Modeling (3 credits, I\*; prerequisites: chemistry, fluid mechanics, COEN 1300)

MCEN 4032 Sustainable Energy (3 credits, F; prerequisite: thermodynamics, heat)

#### Applied Ecology

CVEN 3434 Intro to Applied Ecology (3 credits, S; prerequisites: CHEN 1211-1221)

EBIO 4155 Ecosystem Ecology (3 credits, S; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 or EBIO 3020+)

EBIO 4020 Stream Biology (3 credits, I\*; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 +)

EBIO 4030 Limnology (3 credits, S; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 +)

EBIO 4060 Landscape Ecology (3 credits, F; prereq: CVEN 3434 or EBIO 1240)

EBIO/GEOL/ENVS 4160 Introduction to Biogeochemistry (3 credits; S prereq: CHEM 1011 or higher, EBIO 4155 or GEOL 3320)

#### Energy Conversion Fundamentals

ECEN 3010(S/F) Circuits and Electronics (3 credits, prerequisites: APPM 2360, PHYS 1140)

**1**MCEN 3032 Thermodynamics 2 (3 credits, F&S, prerequisites: MCEN 3012, MCEN 3021 or equivalents)

MCEN 4032 Sustainable Energy (3 credits, F, prerequisite: thermodynamics)

CHEN 3660 Energy Fundamentals (3 credits, S, prerequisite: thermodynamics)

AREN 5020 Building Energy Audits (3 credits, I\*, prereq: AREN 3010 or equivalent, instructor permission required)

AREN 5050 Advanced Solar Design (3 credits, I\*, AREN 2120 or equivalent, instructor permission required)

CVEN 5614 Bioenergy and Bioresources Recovery (3 credits, I\*, desired prerequisite: CVEN 4484, instructor permission required)

#### Engineering for Developing Communities

**1**CVEN 3424 Water and Wastewater Treatment (3 credits, S; prerequisite: CVEN 3414)

CVEN 4554 Fundamentals of Air Quality Management (3 credits, F, Prerequisite: APPM 2360 (or MATH 3130 and 4430) and CHEN 3313 (or CHEN 3200 or MCEN 3021))

GEOG 3682 Geography of International Development (3 credits, F: recommended prerequisite: GEOG 1982, 1992, 2002 or 2412)

EMEN 4200 Technology and Entrepreneurship for the Developing World (3 credits, F or sum; Jrs or Srs only)

CVEN 4837 Sp Top: Global Engineering (3 credits, S)

CVEN 4969 Water Air Sanitation Hygiene (3 cr starting in 2017, prereq: CVEN 3414) New starting in **Spring 17**

#### Remediation

CVEN 4353 Groundwater Engineering (3 credits, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)

**1**CVEN 4474 Hazardous and Industrial Waste Management (3 credits, I\*; prerequisite: CVEN 3414)

EVEN 4100 Environmental Sampling and Analysis (3 credits, F; prerequisites: CVEN 4404/4414, fluid mechanics or instructor consent)

GEOL 3030 Introduction to Hydrogeology (3 credits, F; prerequisites: GEOL 1010 or GEOL 2100 and MATH 1300, or instructor consent)

GEOL 4716 Environmental Field Geochemistry (2 credits, F/I\*; prerequisites: GEOL 2700 or 2001, and CHEM 1011/1031, or CHEM 1113/1133, and GEOL 3320, or instructor consent) + will need to make up extra 1 credit.

MCEN 4057 Environmental Modeling (3 credits, I\*, prerequisites: chemistry, fluid mechanics, CHEN 1310)

#### Water Resources and Treatment

**1**CVEN 3323 Hydraulic Engineering (3 credits, F; prerequisite: CVEN 3313 or CHEN 3200 or CVEN 3313 or GEEN 3853 or MCEN 3021 or AREN 2120)

**1**CVEN 3424 Water and Wastewater Treatment (3 credits, S; prerequisite: CVEN 3414)

**1**CVEN 4323 Water Resource Engineering Design (F, juniors/seniors)

CVEN 4353 Groundwater Engineering (3 credits, F; recommended prerequisite: CVEN 3313 or CHEN 3200 or CVEN 3313 or GEEN 3853 or MCEN 3021)

CVEN 4383 Groundwater Modeling (3 credits, S; prerequisite: CVEN 4353)

CVEN 4594 Water Reuse and Reclamation (3 credits, I\*; Prerequisite: CVEN 3414)

EVEN 4830 Environmental Engineering Process Modeling (3 credits, F; Prereq's Heat Transfer and Thermo.

GEOG 4501 Water Resources and Water Management of the Western U.S. (3 credits, S)  
MCEN 4057 Environmental Modeling (3 credits, I\*; prerequisites: chemistry, fluid mechanics, COEN 1300)

Chemical Processing (these CHEN courses also require CHEN 3200 Fluids & 3320 Thermo, or permission)  
CHEN 4521 Physical Chemistry for Engineers (3 credits, S, prereq: APPM 2350 and CHEN 1211; co-req APPM 2360)  
<sup>1</sup>CHEN 3220 Chemical Engineering Separations and Mass Transfer (3 credits, S, prereqs: CHEN 3200 and CHEN 3320)  
CHEN 4330 Chemical Engineering Reaction Kinetics (3 credits, S; prerequisites: CHEN 3320 and APPM 2360)

### 2.3. Dual Degrees

Students in the College of Engineering and Applied Science may obtain Bachelor of Science degrees in two engineering disciplines or one degree in engineering and a second degree from a department in another college or school of the University. Students must satisfy the curricula for both programs and may need to complete additional credit hours beyond the larger minimum credit hour requirement.

Colorado residents should be aware that the College Opportunity Fund (COF) may not cover all tuition costs associated with a double degree program (those beyond 145 semester credit hours).

### 2.4. Concurrent Bachelor of Science/Master of Science Degree

The Environmental Engineering Program is cooperating with the Department of Civil, Environmental, and Architectural Engineering to offer concurrent EVEN BS/CVEN MS degrees in a five-year curriculum. The purpose of the concurrent EVEN BS/CVEN MS degrees is to allow capable students to gain greater depth of knowledge in environmental engineering by jointly pursuing BS and MS degrees. The concurrent degree program offers students greater flexibility in scheduling technical electives and graduate courses.



EVEN Senior Design Class of 2017

To fit the BS and MS degrees in only five years, students are allowed to count 6 credit hours taken at the graduate level for both the EVEN BS and CVEN MS degrees. Students must first complete the four-year Environmental Engineering Bachelor of Science curriculum (Section 2.1); they then complete the requirements of the CVEN MS degree.

Students seeking to pursue the concurrent EVEN BS/CVEN MS degrees must have a minimum grade point average of 3.25 when they submit an application for admission to the program. Students are expected to submit an application during the sixth or seventh semester of their undergraduate program in EVEN (75 to 110 credit hours). Applications are made to the Department of Civil, Environmental, and Architectural Engineering. The following items are needed to complete an application:

- Concurrent EVEN BS/CVEN MS Degrees application form (no application fee)
- Four letters of recommendation
- University of Colorado Application for Graduate Admission form, Part II only
- Certification by the EVEN Program that the required number of coursework hours have been completed
- Copy of internal transcript

The application deadlines are March 31st for admission to the program for the following fall and October 31st for admission for the following spring semester.

To continue in the program, students must maintain full-time status with a cumulative GPA of 3.25. In addition, to count the two graduate courses (6 credit hours) for both the EVEN BS and CVEN MS degrees, the student must achieve a grade point average of at least 3.5 in the 24 credit hours taken immediately after admission to the program. For the CVEN MS, students may complete the requirements for either the Plan I (thesis), Plan II (report) or Plan III (coursework and final exam) Master of Science degrees.

Students admitted to the concurrent EVEN BS/CVEN MS degrees program who do not meet the requirements for completing the concurrent degrees or who elect not to complete the concurrent degrees may count appropriate graduate courses toward the technical elective (up to 9 credit hours) and environmental engineering upper-division technical elective courses (up to 9 credit hours) requirements for the EVEN BS.

## 2.5. Certificate Programs and Minors

The College of Engineering and Applied Science offers certificate and minor programs, which can be obtained along with the EVEN degree:

**Certificate in Engineering Science and Society:** [www.colorado.edu/herbst/certificate-option](http://www.colorado.edu/herbst/certificate-option) This program considers the question: "How can the increasingly vast powers of science be guided toward the solution of human problems and kept from aggravating them." Students are guided toward courses that will help them identify and become engaged in the ethical and policy issues, and the risks as well as the benefits of engineering, applied science and technology.

**Engineering Management Minor, Engineering Entrepreneurship Certificate and Engineering Management Certificate:** [www.colorado.edu/emp/programs/undergraduate-program](http://www.colorado.edu/emp/programs/undergraduate-program). Students take courses in engineering management, business plan preparation, finance, economics and marketing.

**Global Engineering Minor:** [www.colorado.edu/mcedc/undergraduate-education/undergraduate-minor](http://www.colorado.edu/mcedc/undergraduate-education/undergraduate-minor) Undergraduate minor focusing on how to operate in an international context from an engineering perspective, including international teamwork. Students take courses in global perspective, regional/local perspective, foreign language and acquire a global experience (approved study, research, or internship abroad, or equivalent experience) in coherence with a language/regional course selection.

**Energy Engineering Minor:** [www.colorado.edu/engineering/energy-engineering-minor#](http://www.colorado.edu/engineering/energy-engineering-minor#). The CU Energy Engineering Minor aims to prepare students with the background and tools to be leaders in energy technology, policy and research. The minor requirements consist of a selection of technical energy courses, an energy policy course and an interdisciplinary projects course, which is comprised of students who are enrolled in the energy engineering minor, and is focused on the design and analysis of energy technologies from a technical, economic and policy perspective.

**Engineering Leadership Program:** [www.colorado.edu/engineeringleadershipprogram/](http://www.colorado.edu/engineeringleadershipprogram/). Students have an opportunity to pursue leadership courses and experiences.

More **Minors** are available in the College of Engineering and Applied Science in: Computer Science, Computer Engineering, Electrical Engineering, Electrical Renewable Energy Systems, and Signals and Systems [www.colorado.edu/engineering/academics/guide-degrees-certificates/minors](http://www.colorado.edu/engineering/academics/guide-degrees-certificates/minors) as well as in Applied Mathematics. Minors are also available through the College of Arts and Sciences ([www.colorado.edu/advising/programs-requirements](http://www.colorado.edu/advising/programs-requirements)) and the Leeds School of Business ([www.colorado.edu/leeds/minor-business](http://www.colorado.edu/leeds/minor-business)). Minors typically require 18-33 credits in the discipline, including some specific coursework.

Other certificate and minor programs are available throughout the CU-Boulder campus, in many different disciplines. Some minors are particularly compatible with the EVEN BS degree: Applied Math, Chemistry, Ecology and Evolutionary Biology, Electrical Renewable Energy Systems, Geological Sciences, and Math. The Academic Advisor can provide more details on how these minors fit with the EVEN degree requirements.

## 3. Advising

### 3.1. Advising Process

In the Environmental Engineering Program, all students meet with the Academic Advisor and junior and senior students are assigned a Faculty Mentor to provide career counseling and promote greater student-faculty interaction. Students are **required** to participate in the advising process during designated advising weeks just prior to course registration for each semester. An **advising hold** to block registration remains on each student's record until advising has occurred. Faculty Mentors are also available for all students during any semester by appointment, for academic and career counseling beyond the required pre-registration meetings.

A few weeks before each advising period, the Academic Advisor will announce to students and Faculty Mentors by email the advising period schedule and advising procedures. Students are required to read these important advising messages and to follow the instructions for making appointments with Faculty Mentors or attending group informational and advising sessions. Faculty mentors will give meetings with advisees high priority during this time; please be courteous and meet with your mentor during the designated advising period.

In preparation for the meeting, students should review and plan their courses for the following two semesters using these Environmental Engineering (EVEN) Degree Guidelines and the course schedule for the following semester, which is available through MyCUInfo. After the advising meeting, students must complete an Advising Evaluation Form to provide feedback on the advising process. These forms noted and signed by the advisor, must be returned to the Academic Advisor, who will then remove the advising hold to allow the student to register.

Many academic advising questions pertain to the "logistics" of course scheduling and registration. All of these questions should be directed to the Academic Advisor (see the cover sheet for contact information) instead of the Faculty mentors. The Advisor will provide assistance on procedural questions involving registration, degree plans, graduation requirements, and the petition process. In addition, the Advisor will help students determine whether a particular situation should be discussed with their Faculty Mentors.



Joanne Uleau, EVEN Academic Advisor and Dr. Christopher Corwin, EVEN Instructor.

### 3.2. Program Contact with Students (Email)

Official notices to students concerning Environmental Engineering Program advising, curriculum, registration, graduation requirements, and policies will be made by e-mail. By default, official notices will be sent to your university e-mail address as listed on the student directory on the web ([www.colorado.edu/search/](http://www.colorado.edu/search/)). If you do not think you are receiving official EVEN e-mail correspondence (you should be receiving messages from the Academic Advisor or program director at least every couple of weeks, probably more often), please contact the Academic Advisor to ensure that you are on the e-mail list. To reiterate, the Program is required to notify you only at your CU e-mail address.

The College of Engineering and Applied Science will also send official notices to your CU e-mail address. The college has developed a series of "code words" for the beginning of the subject line to alert you to the content of the message, and the EVEN program tries to use these codes as well:

**ADVISING** – would cover topics such as curricular options, course registration, academic issues, course information, missing pre-requisites, degree progress, etc.

**SCHOLARSHIP** – would include information on scholarships, grants, other sources of funding, CEAS Scholarship Coordinator also uses this.

**GRADUATION** – would include information for graduating seniors such as FE exam, senior checkout, recognition ceremonies, senior survey, etc.

**CAREER DEVELOPMENT** - includes opportunities that will help advance a student's career, e.g. résumé reviews, mock interviewing, meetings with employers, Career Fair, etc.

**JOB** - includes job opportunities for students still in school such as internships, co-ops, and on-campus jobs, as well as information on permanent positions.

**INTERNSHIP** – would include internship/co-op opportunities for students still in school.

**EVENT** – would include upcoming meetings, programs, events, trips, and opportunities for volunteers to participate in various functions

**EXTRACURRICULAR** – would include information on student societies, clubs, etc.

**SURVEY** – for any sort of student survey we are running or sharing on behalf of another party

**DEADLINE** – would include anything with a looming deadline to which you should pay special attention

**ACTION REQUIRED** – used when students need to do something post haste.

### 3.3. Academic Records

An official Environmental Engineering Program academic file will be maintained for each student by the Academic Advisor. This file will contain copies of official documentation related to academic history and progress.

The Environmental Engineering Academic Advisor and Faculty Mentors will strive to provide you with complete, timely, and accurate academic advising; but ultimately, the responsibility of meeting graduation requirements is yours. Consequently, you should ensure that all copies of relevant paperwork are present in your academic file and that you keep your own copies of critical information.

### 3.4. Additional Advising Resources

The College of Engineering and Applied Science's advising website [www.colorado.edu/engineering-advising/](http://www.colorado.edu/engineering-advising/) contains other information, including forms for specific situations.

Students may also be referred to various College of Engineering and Applied Science and University of Colorado counselors for certain issues. In particular, several groups within the College offer academic support, including training on study skills and time management, and one-on-one or small group tutoring. These academic programs and other support services are listed on the college web page [www.colorado.edu/engineering/academics/support](http://www.colorado.edu/engineering/academics/support). At the campus level, students may consult with the following groups:

- Career Services – provides services for resume and interview skills improvement, internship and job postings, and career fairs ([www.colorado.edu/career/](http://www.colorado.edu/career/)) N352 Center for Community (C4C), 303 492 6541)
- Counseling and Psychological Services: A Multicultural Center -- provides a variety of programs and assistance to address general academic or personal issues. (<http://www.colorado.edu/counseling/about>, S440 C4C, 303 492 6766)
- Student Academic Services Center ([www.colorado.edu/sasc/](http://www.colorado.edu/sasc/)) 141 Fleming, 303 492 1416)

### 3.5. Faculty Mentor Assignments

All students in the Environmental Engineering Program will be required to meet with a faculty mentor for the first two years and then assigned a faculty mentor for the last two years. Students entering EVEN by change-of-major and transfer students may also need to meet with the Program Director for a transfer credit evaluation. Students may also confer with the Academic Advisor.

## 4. Academic Policies

Academic policies and guides for the College of Engineering and Applied Science, as well as many forms mentioned in this section, can be found at <http://www.colorado.edu/engineering-advising/get-your-degree/academic-expectations-policies>

### 4.1. Prerequisite and Co-Requisite Courses

Most of the courses in the Environmental Engineering curriculum have prerequisite and/or co-requisite requirements (see tables on pp. 8-9 and the Appendix). The purpose of these requirements is to ensure that you are adequately prepared for subsequent courses.

Students must successfully complete all prerequisite courses before enrolling for a required course in the Environmental Engineering curriculum. Students must also simultaneously enroll in and complete satisfactorily all co-requisite courses. Successful completion means receiving a grade of C- or better (some courses require a grade of C in prerequisites). Grades of D+, D, D-, F, IF, IW, P or NC do not satisfy this requirement. Successful completion of prerequisite and co-requisite courses will be monitored for all required courses in the Environmental Engineering curriculum. Students who do not successfully complete prerequisite and co-requisite courses must retake those courses before advancing in the curriculum. If a student registers for a course without satisfactorily



EVEN 4100: Ground Water Sampling, Fort Collins, CO.

completing prerequisite courses, he/she will be notified that the course must be dropped and, if necessary, the student will be dropped from the course. Students required to retake courses are strongly urged to consult their advisor for advice on how successful academic performance can be achieved.

The prerequisite and co-requisite policy applies only to required and environmental engineering upper-division technical elective courses in the curriculum. If a student has not satisfied all of the prerequisite and co-requisite requirements for an elective course (technical, humanities & social sciences, or free elective), permission to take that elective course must be obtained from the instructor before enrolling in the course.

Courses not listed in the curriculum may be used to satisfy prerequisite and co-requisite requirements if transfer credit or a petition to the Environmental Engineering Program has been approved. College of Engineering and Applied Science petition forms for this purpose may be obtained from the Academic Advisor or at [www.colorado.edu/engineering-advising/forms](http://www.colorado.edu/engineering-advising/forms).

## 4.2. Transfer Credit

Several types of students transfer into the Environmental Engineering program. For all transfer students, the College of Engineering and Applied Science requires that the last 45 credit hours used to fulfill degree requirements must be CU-Boulder coursework taken after admission to the college. More details about the college's transfer credit policies are available online at the following URL on the college website <http://www.colorado.edu/engineering/future-students/transferring-cu>

### 4.2.1. Change of Major: From a College of Engineering Degree to EVEN

Evaluation of the credit hours earned in another engineering degree curriculum in the College of Engineering and Applied Science for credit in EVEN will be done at the first advising meeting with the EVEN Program Director. Grades of C- or better must have been achieved for all courses counting for required courses in the EVEN curriculum. Because EVEN is a multi-department program, most students coming into EVEN from other engineering degree programs in the College are able to transfer most of their basic courses for credit toward the EVEN BS degree. Students changing from another engineering degree to EVEN must complete a change-of-major form for the College.

### 4.2.2. Change of Major: From Another UCB College or School to EVEN

Students transferring into EVEN from another of the University of Colorado at Boulder's Colleges and Schools must complete the Intra-University Transfer (IUT) application process: [www.colorado.edu/engineering-advising/transfer-within-cu](http://www.colorado.edu/engineering-advising/transfer-within-cu). Once the application is approved, credit hours from the non-engineering degree will be evaluated for EVEN credit at the first advising meeting with the EVEN Program Director.

### 4.2.3. Transfer from Another Institution

Students transferring from another university or community college can find information at: [www.colorado.edu/engineering-advising/get-your-degree/transfer-students](http://www.colorado.edu/engineering-advising/get-your-degree/transfer-students). An initial and official transfer credit evaluation is performed by the CU- Boulder Office of Admissions using the transcript from the previous institution(s). Courses in which the student received a grade lower than a C- will not be accepted by the admissions office.

Once the Office of Admissions has completed its evaluation, the student will meet with the EVEN Advisor for evaluation of transfer credits for the EVEN curriculum. Note that acceptance of transfer credits by the admissions office does not ensure that the transfer credits will count toward the EVEN BS degree; courses taken at another institution must match the course requirements for the EVEN curriculum. In many cases, identification of courses is straightforward; however, for some courses, the EVEN Director may request documentation of course content (catalog descriptions, course syllabi).



Environmental Engineering and Water Resources Networking Event, March 2017

#### 4.2.4. Advanced Placement and International Baccalaureate Credit

Advanced Placement (AP) credit may be approved on the basis of College Entrance Examination Board's Advanced Placement tests. International Baccalaureate (IB) credit may be granted to students who have participated in IB diploma or certificate programs. For students who have taken AP or IB courses in high school and who achieve the required score, AP/IB credit will be granted as part of the admission process. AP and IB credits must also be evaluated for credit toward the EVEN curriculum by the EVEN Academic Advisor. If a student later takes a course for which AP or IB credit was granted, the credit for the course taken at the University of Colorado will replace the AP/IB credit.

For a listing of CU course equivalents for typical AP and IB credit, see the College of Engineering and Applied Science "Advanced Placement, IB and MAPS" Advising Guide online at [www.colorado.edu/engineering-advising/sites/default/files/attached-files/ap\\_ib.pdf](http://www.colorado.edu/engineering-advising/sites/default/files/attached-files/ap_ib.pdf).

College courses taken while in high school (e.g., through the "CU Succeed" Program) will be evaluated as transfer credits according to the applicable section above.

#### 4.2.5. Continuing Education Courses

Courses may be taken for EVEN degree credit through programs offered by the University of Colorado's Division of Continuing Education: [www.colorado.edu/ContEd/](http://www.colorado.edu/ContEd/).

### 4.3. Humanities and Social Sciences Electives

#### 4.3.1. Importance of Humanities and Social Sciences to Environmental Engineers

The purpose of humanities and social sciences (H&SS) electives is to broaden the engineering education. In environmental engineering, appreciation and knowledge of the social, historical, political, and economic context of environmental problems is critically important. The EVEN faculty recommends that you select a sequence of courses that complement and broaden your education in environmental engineering and that you avoid random selection of unrelated introductory courses.



Joe Ryan (third from left) examines waste rock from a mine in St. Kevin Gulch near Leadville with students from the EVEN 4830 Multidisciplinary Approaches to Abandoned Mine Remediation course.

#### 4.3.2. Humanities and Social Sciences Requirements

The Environmental Engineering Program follows the College of Engineering and Applied Science H&SS requirements [www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-writing-requirements/alphabetic-list](http://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-writing-requirements/alphabetic-list). A total of 15 credit hours of H&SS electives is required for graduation. At least six of the required credit hours must be at the upper division level (3000- or 4000-level courses). In addition, a writing course is required to improve writing and oral presentation skills. **Instructor's consent must be obtained on a petition form if prerequisites are not met.** Permission must be obtained from the relevant department if courses have other restrictions.

**The writing requirement may be fulfilled by one of the following courses:**

- HUEN 1010 Humanities for Engineers: The Human Quest (restricted to freshmen)
- HUEN 3100 Advanced Humanities for Engineers: The Human Quest Continues (prerequisite: junior standing & program approval)
- PHYS 3050 Writing in Physics: Problem-Solving and Rhetoric (prereq: PHYS 2130 or 2170 and lower-division core writing requirement)
- WRTG 3030 Writing on Science and Society (restricted to junior/senior engineering/physical and biological science majors)
- WRTG 3035 Technical Communication and Design (restricted to junior/senior majors in engineering, architecture & planning, physical, earth and life sciences)

### 4.3.3. Some Specific Inclusions and Exclusions for the H&SS List

Most foreign language courses will satisfy the humanities and social science requirements. Generally, courses in performance and fine arts production, mathematics, and natural sciences are not acceptable as H&SS electives. Some courses in the history of art, music, theatre, dance or film are acceptable. The following courses are specifically excluded from satisfying H&SS requirements:

- courses in painting, sculpture, photography, film and other fine arts production
- courses in musical instruments, band, choir, and other performance courses
- courses in accounting, finance, personnel administration, and other business practices
- critical thinking courses in science departments
- These courses may be taken as free electives

## 4.4. Technical Electives

### 4.4.1. Overview of Technical Electives

Technical electives provide an opportunity for students to explore a range of engineering, mathematical, and natural sciences topics to provide increased breadth or to focus on a specific technical area to develop in-depth understanding. In addition, one technical elective must be used to meet a requirement for a course in earth sciences. Students should consult the Academic Advisor or their Faculty Mentors to plan their technical elective program. The requirements for the three environmental engineering upper-division technical elective courses are discussed in Section 2.2.

### 4.4.2. Technical Elective Requirements

The EVEN BS curriculum requires nine credit hours of technical electives. Technical elective credit may be met by courses in the following categories:

- most engineering, physics, biology (both EBIO and MCDB), chemistry, geology, physical geography, atmospheric and oceanic sciences, and mathematics (both APPM and MATH) courses that are substantially different from required EVEN courses;
- many courses taught by Computer Science and Engineering Management;
- quantitatively rigorous courses in social sciences (economics, psychology, human geography);
- EVEN senior thesis; and
- independent study courses with appropriate technical content.

Three credit hours of technical electives may be lower division (1000-, 2000-level course). The remaining technical elective courses must be taken at the 3000-level or above. Both undergraduate and graduate courses (5000 level and above) may be taken as technical electives; enrollment in graduate courses requires the consent of the instructor.

One of the technical elective courses (3 credit hours) must be an earth science course at either the lower or upper division level.

All technical elective course selections should be approved by your advisor. Technical electives counted toward the graduation requirements for the EVEN BS degree **may not** be taken pass/fail.

Exceptions to these rules will be considered by petition to the Environmental Engineering faculty.

### 4.4.3. Specific Inclusions and Exclusions for Technical Electives

Independent study (see Section 4.7) is accepted as technical elective credit up to a maximum of 6 credit hours.

Co-op credits will not count as technical electives nor toward other degree requirements, except as free elective credits.

A maximum of 3 credit hours of some Reserve Officer Training Corps (ROTC) courses may be used as technical electives upon commissioning.

### 4.4.4. Earth Science Technical Electives

Courses that meet the earth sciences requirement are typically found in the Departments of Geological Sciences, Geography, Atmospheric and Oceanic Sciences, and some engineering departments.

Please see list here, courses with an \* next to them satisfy earth science courses, please note the credits needed (3).

[www.colorado.edu/even/sites/default/files/attached-files/technical\\_electives\\_2016-17\\_6-8-16.pdf](http://www.colorado.edu/even/sites/default/files/attached-files/technical_electives_2016-17_6-8-16.pdf)

**Note: If using ATOC 1050 or GEOL 1010 to satisfy Air or Earth Science Laboratory or Field Course, you may not use them to also satisfy a Tech Elec.**

## 4.5. Free Electives

The EVEN curriculum allows for two credits of free elective(s). College-level CU or transfer credits, upper- or lower division, may be used for these credits to broaden the student's academic experience. Students may also use AP or IB credits, courses from Residential Academic Programs (RAP), President's Leadership Class (PRLC), ROTC, courses required to pursue a minor, etc., as long as they are substantially different from required EVEN courses. Or they may be used to take a "fun" class in something you always wanted to study!

## 4.6. Air or Earth Science Laboratory or Field Course

Students are required to take one 3-credit course with a significant lab or field component focusing on air quality or earth science. If the course chosen is less than three credits, the difference is required as **an upper division technical electives** or accompanying lecture (Note: courses taken to complete this Air or Earth Science Lab/Field course cannot be used to fulfill both a technical elective and this lab/field requirement on the same student record).



EVEN 1000, Introduction to Environmental Engineering with Professor R. Scott Summers, EVEN Program Director

### The following courses will fulfill the lab/field requirement:

- **ATOC 1070** Weather and the Atmosphere Lab (1) **AND ATOC 1050** Weather and the Atmosphere (3) (prereq or co req: ATOC 1050 or instructor consent)
- **CVEN 3708** Geo technical Engineering 1 (3) (prerequisite: CVEN 3161)
- **EVEN 4100** Environmental Sampling and Analysis (3) (prerequisites: CVEN 4404 & 4414 and fluid mechanics or instructor consent)
- **GEOL 1030** Introduction to Geology Lab (1) **AND GEOL 1010** Introduction to Geology (3) (prior or current registration in 1000 level GEOL recommended)
- **GEOL 2700** Introduction to Field Geology (2) **AND GEOL 1010** Introduction to Geology (1) (prerequisites: GEOL 1010 & 1030)
- **GEOL 3010** Introduction to Mineralogy (3) (prerequisites: CHEM 1113/CHEN 1211, MATH 1300/APPM 1350)
- **GEOL 4716** Environmental Field Geochemistry (2) (Requires prerequisite courses of GEOL 2001 or GEOL 2700 and GEOL 3320 and CHEM 1011 and CHEM 1031 or CHEM 1113 and CHEM 1133)

### Another option:

- **ATOC 1070** (1) **AND Upper Tech Elec** (2-3) (ATOC 1050 will be used as your Lower level Tech Elec to satisfy Earth Science)
- **GEOL 1030** (1) **AND Upper Tech Elec** (2-3) (GEOL 1010 will be used as your Lower level Tech Elec to satisfy Earth Science)

## 4.7. Independent Study

### 4.7.1. Introduction to Independent Study

An independent study is a collaboration between a student and a faculty member on a special project that provides the student with a learning experience. An independent study may also fill an academic need of importance to the student that cannot be filled by the regular course offerings. Independent studies are opportunities for students to earn credit for learning outside the normal lecture and laboratory class structure.

In the EVEN BS curriculum, independent studies may be counted as technical electives (up to a maximum of six credit hours) or free elective. Independent studies may be conducted in any increment of credit hours up to a maximum of 3 credit hours per semester, with one credit hour representing 25 hours of actual work on the task or project. The Environmental Engineering Program encourages students to consider independent study to engage in a long-term research project with a faculty member.

## 4.7.2. Independent Study Requirements

The following rules apply to independent studies:

- ❑ A maximum of 6 credit hours of independent study may be applied to EVEN BS degree requirements as technical electives.
- ❑ Independent studies may not be applied as required courses or Environmental Engineering TE courses.
- ❑ A maximum of 3 credit hours of independent study may be taken per semester.
- ❑ Independent studies may be supervised by any appropriate University of Colorado faculty member.
- ❑ A proposal for an independent study must be made by submitting the Independent Study Agreement Form, complete with student and supervising faculty signatures.
- ❑ The EVEN Program Director must approve the proposal.
- ❑ A final product of the independent study must be submitted to the Environmental Engineering Program before credit is awarded toward degree requirements.
- ❑ Approval of a second independent study is contingent on successful completion of the requirements for the first independent study.
- ❑ Independent studies may not be arranged retroactively.
- ❑ Independent study credit is not allowed for internship experiences, co-ops, work-study, or work done for pay, following University rules.



SEVEN, Society of EVEN is a resource for engineering students to connect and explore applications of environmental engineering

## 4.7.3. Independent Study Procedures

To propose an independent study, students must first determine with a collaborating faculty member the topic, goals, number of credit hours, work plan, and required product for the independent study. This information must be recorded on an Independent Study Agreement Form (see the Forms Appendix) and submitted before the drop/add deadline of the semester in which the independent study will be conducted.

The independent study proposal will be reviewed by the EVEN Director and approved, returned for amendment, or disapproved owing to some deficiency in the proposal. The form must then be submitted to the Academic Advisor. For an EVEN independent study, the Academic Advisor will enroll the student. The student will conduct the independent study under the guidance of the Faculty Advisor. At the end of the independent study, the student must submit to the Environmental Engineering Program a copy of the final product (a report, a computer code, etc.) in addition to any required products due to the collaborating faculty.

## 4.8. Senior Thesis

Students in their final year may choose to do a senior thesis, which is conducted over two terms and demonstrates that a student can complete scientific and engineering research independently and can communicate results. A senior thesis must be supervised and graded by a member of the Environmental Engineering faculty and defended before a committee of three faculty members, two of whom must be affiliated with the Environmental Engineering Program. Senior thesis hours (3 credits each term) may be applied toward the technical elective requirement.

The student is required to complete (in collaboration with the thesis supervisor) and sign a Senior Thesis Proposal form for each semester; the form must then be signed by the student and thesis supervisor and approved by the EVEN Program Director before registration in the courses. The final thesis must be submitted to the Environmental Engineering Academic Advisor by the final day of the second term of the thesis. More details on senior thesis policy and procedures may be found on the Senior Thesis Proposal Forms (see Forms Appendix).

## 4.9. Engineering Co-op Program

A Co-operative Education Program is available to EVEN students, whereby semesters of academic coursework alternate with semesters of paid engineering work at an engineering firm or university. International co-ops are also available. The co-op program provides professional experience in a real-world situation with university oversight and a chance to explore career options during the undergraduate career. Students enroll in co-op credit hours through the Division of Continuing Education; these credits do not apply toward degree requirements except as free electives. For more information, see <http://www.colorado.edu/activelearningprogram/professional-learning/cooperative-education-program>.

## 4.10. Petitions

Any exceptions or waivers of the rules and regulations of the Environmental Engineering Program or the College of Engineering and Applied Science must have prior approval by petition. The petition must be completed and submitted to the Environmental Engineering Program for approval; the petition may then be forwarded to the Dean's Office. Exceptions to the humanities/social sciences requirement must also be approved by the Director of the Herbst Program of Humanities for Engineers. It is the student's responsibility to follow up on the petition's progress. Petition forms may be obtained from the Academic Advisor, the dean's office, or from [www.colorado.edu/engineering-advising/forms](http://www.colorado.edu/engineering-advising/forms).

The following list provides some examples of situations for which a petition is required:

- enrolling in less than 12 or more than 19 credit hours per semester
- enrolling in a course when prerequisites have not been satisfied (requires instructor signature)
- substituting for or waiving a required course
- dropping or adding a course after deadlines
- requesting the pass/fail or no credit (NC) grade option for a course
- when more than half of a semester's credit hours do not meet degree requirements
- to ensure that courses taken elsewhere will count toward degree requirements (including study abroad courses) to request approval of technical electives or humanities and social sciences classes that are not on the approved list follow these guidelines when completing the petition: review the rules and policies of the College of Engineering and Applied Science as published in the University of Colorado Catalog and EVEN Degree Guidelines during the year of your admission to the College and the current edition(s) of the appropriate Advising Guide(s) to establish your need to petition and the specific rule or policy you wish to waive
- consult with the Academic Advisor for clarification of Program rules and policies
- write or, preferably, type the petition clearly (and neatly!)
- provide complete information in the petition, including the number and title of all courses and pertinent data such as course description and syllabi. Additional pages may be attached if necessary.

If properly completed, the petition process will normally take one to two weeks.

## 4.11. Academic Honesty

The Environmental Engineering Program adheres to the policies of the University of Colorado at Boulder and the College of Engineering and Applied Science on academic honesty, which state:

"As members of the academic community, students have a responsibility to conduct themselves with the highest standards of honesty and integrity. These qualities are also vital to the profession of engineering. Violations of academic ethics tarnish the reputation of all students and will be treated with the utmost seriousness."

Be forewarned and discourage your fellow students from participating in any unethical activities. The following are examples of some, but certainly not all, acts that violate academic ethics:

- plagiarizing
- cheating on assignments and exams (including text messaging during exams, quizzes, etc.)
- possessing or observing of exams or solutions to examinations prior to the exam
- altering, forging, or falsifying official records
- performing work or taking an exam for another student
- providing material/work of your own or of others to a fellow student [www.colorado.edu/policies/student-honor-code-policy](http://www.colorado.edu/policies/student-honor-code-policy)

## 5. Graduation Requirements

### 5.1. Requirements for EVEN BS Degree

#### 5.1.1. General Requirements

To graduate with a Bachelor of Science degree in Environmental Engineering from the College of Engineering and Applied Science at the Boulder campus, students must meet the following minimum requirements:

1. Satisfactory completion of the required and elective courses in the Environmental Engineering Bachelor of Science curriculum. Students must satisfactorily complete a minimum of 128 credit hours, of which the last 45 credit hours shall be CU-Boulder coursework earned after admission to the College of Engineering and Applied Science as a degree student.
2. A minimum CU cumulative grade point average of 2.250 for all courses attempted and for all courses that count toward graduation requirements, excluding "P" grades for courses taken Pass/Fail.
3. A minimum cumulative major grade point average of 2.250. This major grade point average includes only course work in EVEN, CHEN, CVEN and MCEN courses.
4. Successful completion of the Minimum Academic Preparation Standards (MAPS) requirement of the College of Engineering and Applied Science.
5. Submission of copies of independent study or thesis final product(s), if applicable toward degree requirements.
6. Completion of the Fundamentals of Engineering (FE) examination during the final academic year.
7. Notification to the EVEN Academic Advisor of intent to graduate.
8. Submission of a request for diploma/graduation.



EVEN Graduation Class - May 2017

Graduation will be postponed by failure to complete these requirements. Any exceptions to these requirements will require approval of the Environmental Engineering Program Director and the Dean's office by petition. In addition, students must be recommended for graduation by the faculty of the EVEN Program and the faculty of the college, and should complete the senior survey.

To be sure that all requirements are met, students can consult with the Environmental Engineering Academic Advisor, Director, and their Faculty Mentors. **Students must be aware that meeting graduation requirements is ultimately their own responsibility.**

#### 5.1.2. Grading Policy

Students are evaluated by their performances in the courses that make up the Environmental Engineering curriculum following the standard procedures implemented by the College of Engineering and Applied Science

([www.colorado.edu/engineering-advising/get-your-degree/academic-expectations-policies](http://www.colorado.edu/engineering-advising/get-your-degree/academic-expectations-policies)). Student performance is determined by course instructors. Instructors award grades following the University of Colorado standardized grading system (Table 5.1).

Grade point averages of students are determined only for "quality credit hours". Quality credit hours are those earned in courses taken for standard grades at the University of Colorado. "Earned credit hours" include quality credit hours plus credit hours earned in courses taken pass/fail and credit hours transferred from other institutions; thus, grades in pass/fail courses and courses from other institutions do not count in the University of Colorado grade point average.

Other grades appearing on student transcripts include Incomplete (I), No Credit (NC), and Pass (P). A grade of I indicates that course requirements were not completed owing to documented reasons beyond the control of the student.

Grades of I require completion of an "Incomplete Grade Record Form" by the instructor and student stating the work that must be completed to award a final grade. All work required for the final grade must be completed within one year or the I grade is changed to F. A grade of NC indicates that the course taken cannot be used to fulfill graduation requirements and cannot be repeated for a standard grade. A grade of P in a course taken pass/fail indicates that the student achieved the minimum passing grade of D- or better.

### 5.1.3. Pass/Fail Grading

Pass/fail grading is permitted only for courses used as H&SS electives or for courses above and beyond degree requirements. The primary purpose for offering the opportunity for students to enroll in a course for a grade of P or F instead of a standard letter grade is to encourage students to broaden their educational experience by selecting challenging courses without serious risk to the cumulative grade point average. Students on academic probation may not elect the P/F grade option.

The College allows a maximum of six pass/fail credit hours per semester. Pass/fail hours counting toward graduation shall not exceed a cumulative total of 16 (Study Abroad pass/fail grades do not count toward this limit).

Transfer students are allowed one credit hour pass/fail for every nine credit hours completed under the Standard Grading System. Students are required to submit a petition requesting approval to register for a course with the pass/fail option.

**Table 5.1.** Standardized grading system of the University of Colorado at Boulder.

| letter grade | credit points | quality of performance                             |
|--------------|---------------|--|
| A            | 4.0           | superior/excellent                                 |
| A-           | 3.7           |  |
| B+           | 3.3           |  |
| B            | 3.0           | good/better than average                           |
| B-           | 2.7           |  |
| C+           | 2.3           |  |
| C            | 2.0           | competent/average                                  |
| C-           | 1.7           | (minimum passing grade in prerequisite course)     |
| D+           | 1.3           |  |
| D            | 1.0           |  |
| D-           | 0.7           | (minimum passing grade in non-prerequisite course) |
| F            | 0.0           |  |
| I            |               | incomplete   |
| NC           |               | no credit  |
| P            |               | pass in a pass/fail course                         |

## 5.2. Fundamentals of Engineering Exam

One of the requirements for graduation with the EVEN BS degree is that students must take the Fundamentals of Engineering (FE) Exam. This test serves two purposes: (1) it provides students the opportunity to complete the first step towards Professional Engineer (PE) status and (2) it provides the Environmental Engineering Program with a useful assessment of engineering proficiency attained by EVEN graduates. Students usually take the FE Exam during their final semester.

The Fundamentals of Engineering Examination is the first step toward achieving licensure as a Professional Engineer (PE), a particularly important credential for engineers working as consultants. The FE Exam is administered by the National Council of Examiners for Engineering and Surveying (NCEES).

The FE Exam is offered in testing windows throughout the year: Jan-Feb, Apr-May, Jul-Aug, Oct-Nov (exams are NOT offered during March, June, September, or December). Students will register online with NCEES and with a paper application from DORA. Registration notices will be distributed by the EVEN Academic Advisor.

The exam covers engineering, science, and mathematics fundamentals. It is also discipline-specific. The NCEES offers general information, study materials, and sample questions for the FE Exam. Numerous review books for the FE Exam are also readily available at web booksellers.

## 5.3. Requirements for Dual Degrees

Students may choose to pursue a second Bachelor of Science or Bachelor of Arts degree simultaneously with the EVEN BS degree in a College or School at the University of Colorado at Boulder. To do this, they must satisfy the requirements of both degree curricula and may be required to take credit hours beyond the 128 required for the EVEN BS degree. To complete a dual degree, the student should find an Academic Advisor in the other program to ensure that its course requirements are satisfied.

## 6. Society of Environmental Engineers (SEVEN)

The Society of Environmental Engineers (SEVEN) is a student society which engages in a combination of educational, service and social activities. It is open to students in all majors who are interested in environmental issues and sustainable solutions. See [www.colorado.edu/even/current-students/seven-society-even](http://www.colorado.edu/even/current-students/seven-society-even) for more information about meetings and activities, and to contact the current officers.

## 7. Faculty Directory

More than twenty College of Engineering and Applied Science faculty members are affiliated with the Environmental Engineering Program. These faculty members are rostered in the Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering departments.

**Rajagopalan Balaji**, Professor, Civil, Environmental, and Architectural Engineering, Department Chair

Education: B.Tech. in Civil Engineering, National Institute of Technology, Kuruksheetra, India (1989), M.Tech. in Operations Research and Reliability, Indian Statistical Institute, Calcutta, India (1991), Ph.D. in Stochastic Hydrology and Water Resources, Utah State University, Logan, UT (1995)

Research: Hydrology, Water Resources and Environmental Fluid Mechanics.

Email: [balajir@colorado.edu](mailto:balajir@colorado.edu), phone: 303-492-5968, office: ECOT 444

**Angela Bielefeldt**, Professor, Civil, Environmental, and Architectural Engineering, former EVEN Director,

Education: B.S., Iowa State University (1992), M.S., Ph.D., University of Washington (1994, 1996)

Teaching: CVEN 4474 Hazardous Waste Management

Research: Engineering Education, In-situ Bioremediation, Sustainable water and wastewater treatment for developing communities

Email: [angela.bielefeldt@colorado.edu](mailto:angela.bielefeldt@colorado.edu), phone: 303 492 8433, office: SEEC S274

**Sherri Cook**, Assistant Professor, Civil, Environmental, and Architectural Engineering

Education: B.S., Virginia Polytechnic Institute and State University (2008), M.S.E., Ph.D., University of Michigan (2009, 2014)

Teaching: CVEN 5534 Wastewater Treatment, CVEN 4834 Sustainability Principles for Engineers

Research: Sustainable water system design, resource recovery from waste, environmental biotechnology, biological process stability and reliability.

Email: [Sherri.Cook@colorado.edu](mailto:Sherri.Cook@colorado.edu) Phone: 303 735 7288, Office: SEEC S299

**Chris Corwin**, Instructor, Civil, Environmental, and Architectural Engineering

Education: B.S., University of Kentucky (1996), M.S., Ph.D, University of Colorado (2007, 2010)

Teaching: CVEN 3414 Fundamentals of Environmental Engineering, CVEN 3424 Water and Wastewater Treatment, EVEN 4434 Environmental Engineering

Design, EVEN 4464 Environmental Engineering Processes

Email: [Christopher.corwin@colorado.edu](mailto:Christopher.corwin@colorado.edu), phone: 303.492.7651, office: ECES 103B

**William Emery**, Professor, Aerospace Engineering Science

Education: B.S., Brigham Young U. (1971), Ph.D., U. Hawaii (1975)

Teaching: ASEN 4337 Remote Sensing Data Analysis, ASEN 4215 Oceanography, ASEN 5168 Remote Sensing Instrument

Research: Satellite Remote Sensing of Oceans, Vegetation and Urban Studies

Email: [william.emery@colorado.edu](mailto:william.emery@colorado.edu), phone: 303 492 8591, office: ECNT 220

**Michael Gooseff**, Associate Professor, Civil, Environmental and Architectural Engineering, INSTAAR

Education: BCE, Georgia Tech; MS and PhD, University of Colorado, Boulder

Teaching: CVEN 5333 Physical Hydrology

Research: Modeling water quality in surface waters, contaminant fate and transport, ecosystem response to climate change, polar aquatic and general ecosystem research

Email: [michael.gooseff@colorado.edu](mailto:michael.gooseff@colorado.edu), phone: 303-735-5333, office: SEEC S217

**Michael Hannigan**, Associate Professor, Mechanical Engineering

Education: B.S., Southern Methodist University (1990), M.S., Ph.D., California Institute of Technology (1991, 1997)

Teaching: MCEN 4228 Sustainable Energy, MCEN 3037 Experimental Design and Data Analysis, MCEN 4131 Air Pollution Control

Research: Characterization and Abatement of Air Pollution, Impact of air quality on health, Energy links to air quality

Email: [michael.hannigan@colorado.edu](mailto:michael.hannigan@colorado.edu), phone: 303 735 5045, office: ECME120

**Daven Henze**, Assistant Professor, Mechanical Engineering

Education: B.S., University of Washington (2001), M.S., Ph.D., California Institute of Technology (2004, 2007)

Teaching: MCEN 4131 Air Pollution Control

Research: Aerosols and Air Quality, Climatology and atmospheric chemistry, Adjoint sensitivity analysis, Data assimilation and remote sensing & modeling tools

Email: [daven.henze@colorado.edu](mailto:daven.henze@colorado.edu), phone: 303 492 8716, office: ECME 265

**Mark Hernandez**, Professor, Civil, Environmental, and Architectural Engineering

Education: B.S., M.S., Ph.D., Post-Doctoral Fellowship, University of California at Berkeley (1986, 1988, 1994, 1996)

Teaching: EVEN 5/4484 Environmental Microbiology and Toxicology, AREN 2110 Thermodynamics, CVEN 3434 Applied Ecology, GEEN 1400 Freshman Projects

Research: Forensic Environmental Microbiology, Biochemistry and Toxicology of Natural and Engineered Systems: Aerobiology, Disinfection and Corrosion

Email: [mark.hernandez@colorado.edu](mailto:mark.hernandez@colorado.edu), phone: 303 492 5991, office: SEEC S269

**Jean Hertzberg**, Associate Professor, Mechanical Engineering

Education: B.S., U. Michigan (1981), M.S., Ph.D., University of California at Berkeley (1983, 1986)

Teaching: MCEN 3012 Thermodynamics, MCEN 3021 Fluid Mechanics, MCEN 4030 Computational Methods, MCEN 4228 Perception of Design

Research: Flow Visualization, Fluids Education, Experimental Vortex Dominated Fluid Dynamics, Applications in Combustion and Biomechanics, Combustion Fluid Mechanics, Hazardous Waste Destruction

Email: [jean.hertzberg@colorado.edu](mailto:jean.hertzberg@colorado.edu), phone: 303 492 5092; office: ECME 220

**Amy Javernick-Will**, Associate Professor, Civil, Environmental, and Architectural Engineering

Education: B.S., University of Colorado Boulder (1999), M.S., University of Colorado Boulder (2001), Ph.D., Stanford University (2009)

Teaching: AREN 4506 Pre-construction Estimating and Scheduling; CVEN 5346 Managing Engineering and Construction Organizations

Research: Disaster Recovery, Community Resiliency, Knowledge Mobilization, Socially sustainable infrastructure projects, Engineering Education  
Email: amy.javernick@colorado.edu

**Joseph Kasprzyk**, Assistant Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., Pennsylvania State University (2007); M.S., Pennsylvania State University (2009); Ph.D., Pennsylvania State University (2013)  
Teaching: CVEN 4333 Engineering Hydrology, CVEN 5423 Water Resources Engineering, CVEN 5393 Water Resource Systems and Management  
Research: water resources planning and management, hydrologic modeling, multi-objective decision support, systems analysis, coupled natural-human systems

Email: joseph.kasprzyk@colorado.edu, phone: 303 492 1818; office: SEEC C244

**Rita Klees**, Scholar-in-Residence, Civil, Environmental, and Architectural Engineering  
Education: B.A. College of St. Catherine (1972), M.A. University of Chicago (1975), Ph.D. and M.S. University of Colorado (1986, 1989)  
Teaching: CVEN 5919 Sustainable Community Development I, CVEN 5929 Sustainable Community Development II, CVEN 5939 Field Practicum, CVEN 5969 Water, Sanitation and Hygiene (WASH), SSIR 1010 Social Entrepreneurship and Sustainability  
Research: Sustainable Community Development; WASH in International Development; Sustainable WASH Service Delivery  
Email: rita.klees@colorado.edu

**Kristine Larson**, Professor, Aerospace Engineering Sciences  
Education: A.B., Harvard University (1985), Ph.D., University of California, San Diego (1990)  
Teaching: ASEN 2012 Exptl/Computational Methods

Research: Applications of GPS, incl. navigation, positioning, precise orbit determination, earthquakes, volcanoes, soil moisture, snow depth, and vegetation sensing

Email: kristine.larson@colorado.edu, phone: 303 492 6583; office: ECAE177

**Karl Linden**, Helen and Huber Croft Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., Cornell University, (1989), M.S., Ph.D., University of California (1993, 1997)  
Teaching: CVEN 5969 Water, Sanitation and Hygiene, CVEN 4594/5494 Water Reuse, CVEN 5604 UV Processes  
Research: Water Treatment, Wastewater Treatment, Disinfection, Advanced Oxidation  
Email: karl.linden@colorado.edu, phone: 303 492 4798, office: SEEC S291A

**Ben Livneh**, Professor, Civil, Environmental, and Architectural Engineering  
Education: B.E.Sc., M.E.Sc. University of Western Ontario (2004-2006), Ph.D. University of Washington (2012)  
Teaching: CVEN 5363 Modeling Hydrologic Systems, CVEN 4333 Engineering Hydrology

Research: Climate and land cover change impacts on water resources, computational hydrology, land surface modeling, terrestrial water and energy balances

Email: ben.livneh@colorado.edu phone: 303-735-0288, office: SEEC C251

**Diane McKnight**, Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., M.S., Ph.D., Massachusetts Institute of Technology (1975, 1978, 1979)  
Teaching: CVEN 3434 Applied Ecology, CVEN 5323 Applied Stream Ecology

Research: Aquatic Ecology, Limnology, Reactive transport of metals and organic material in streams and rivers

Email: diane.mcknight@colorado.edu, phone: 303 492 4687 or 492 7573, office: ECES 124 or LITR 115

**Jana Milford**, Professor, Mechanical Engineering; former EVEN Director  
Education: B.S., Iowa State University (1983), M.S., Ph.D., Carnegie Mellon University (1985, 1988), J.D., University of Colorado School of Law (2004).  
Teaching: MCEN 4131 Air Pollution Control, MCEN 3012 Thermodynamics, MCEN 4228 Env. Modeling, MCEN 5228 Env. Law for Engineers, MCEN 4228 Sustainable Energy

Research: Air Quality Modeling, Atmospheric Chemistry, Air pollution source apportionment, Environmental law and management

Email: jana.milford@colorado.edu, phone: 303 492 5542, office: SEEC S286D

**Shelly Miller**, Associate Professor, Mechanical Engineering  
Education: B.S., Harvey Mudd College (1986), M.S., Ph.D., University of California at Berkeley (1991, 1996)  
Teaching: MCEN 4131 Air Pollution Control, MCEN 4141 Indoor Air Pollution, GEEN 1400 Engineering Projects, MCEN 3121 Thermodynamics 1, MCEN 3122 Thermodynamics 2.

Research: Urban Air Quality, Indoor Air Quality, Bioaerosols, Air Pollution Control Technologies including Infection Control

Email: shelly.miller@colorado.edu, phone: 303 492 0587; office: SEEC S286C

**Lupita Montoya**, Assistant Professor, Civil, Environmental, and Architectural Engineering  
Education: BS, California State University, Northridge; MS, PhD Stanford University (1999)  
Teaching: AREN 2110 Thermodynamics, CVEN 4834/5834 Fundamentals of Air Quality Science and Engineering, GEEN 1400 Engineering Projects  
Research: Health effects of aerosols, indoor air quality and exposure, sustainability

Email: lupita.montoya@colorado.edu, phone: 303 492 7137; office: SEEC S286A

**Roseanna Neupauer**, Associate Professor, Civil, Environmental and Architectural Engineering  
Education: B.S., Carnegie Mellon University (1989); S.M., Massachusetts Institute of Technology (1991); M.S., PhD, New Mexico Tech (1999, 2000)  
Teaching: CVEN 4353/5353 Groundwater Engineering; CVEN 3323 Hydraulics

Research: groundwater flow and transport modeling, stream-aquifer interaction, groundwater remediation, chaotic advection

Email: Roseanna.Neupauer@colorado.edu; phone: 303 492 6274; office: SEEC C245

**John Pellegrino**, Research Professor; Mechanical Engineering  
Education: B.ChE. City College of New York (1973), M.S., Ph.D., (ChE) University of Colorado at Boulder (1979, 1983)286Z

Teaching: Fluid Mechanics, Membranes, Energy, Separations

Research: Modification, formation, characterization, and performance of membranes, Electrokinetic processes, Water treatment and supply, Biomass-to-fuels process development

**Harihar Rajaram**, Professor and President's Teaching Scholar, Civil, Environmental, and Architectural Engineering  
Education: B.Tech., IIT, Madras (1985), M.S., U. Iowa (1987), Sc.D., M.I.T. (1991)  
Teaching: CVEN 3313 Fluid Mechanics, CVEN 5537 Numerical Methods in Civil Engg, CVEN 5343 Environmental Transport and Dispersion  
Research: Fluid Mechanics and Transport Phenomena in Earth and Environmental Systems, Groundwater, Glaciology, Glacier Hydrology  
Email: harihar.rajaram@colorado.edu, phone: 303 492 6604, office: ECOT 646

**Zhiyong "Jason" Ren**, Associate Professor, Civil, Environmental, and Architectural Engineering  
Education: Ph.D Pennsylvania State University, 2008  
Teaching: EVEN 4484/5484 Introduction to Environmental Microbiology, CVEN 5834 Energy and Resource Recovery  
Research: Bioenergy and resource recovery, biological treatment processes, microbial fuel cells, oil/gas water management, water desalination  
Email: Zhiyong.Ren@Colorado.EDU, phone: 303 492 4137, office: SEEC S291B

**Fernando Rosario-Ortiz**, Assistant Professor, Civil, Environmental, and Architectural Engineering

Education: B.S., University of Puerto Rico, M.S. California Institute of Technology, D.Env. UCLA,

Teaching: EVEN 4424 Environmental Organic Chemistry, CVEN 5454 Water Chemistry

Research: Wastewater reuse, Advanced oxidation processes for water treatment, Natural organic matter, Environmental photochemistry

Email: Fernando.Rosario@colorado.edu, phone: 303 492 7607, office: SEEC S295B

**Joseph Ryan**, Professor, Civil, Environmental, and Architectural Engineering; former EVEN Director

Education: B.S., Princeton U. (1983), M.S., Ph.D., Massachusetts Institute of Technology (1988, 1992)

Teaching: EVEN 4424 Environmental Organic Chemistry, CVEN 5404 Water Chemistry, EVEN 4100 Environmental Sampling and Analysis.

Research: Contaminant Fate and Transport in Natural Waters, Surface and Colloid Chemistry, Sources and transport of metals in watersheds affected by acid mine drainage

Email: joseph.ryan@colorado.edu, phone: 303 492 0772, office: SEEC S286B

**JoAnn Silverstein**, Professor, Civil, Environmental, and Architectural Engineering

Education: B.S., M.S., Ph.D., University of California at Davis (1978, 1980, 1982)

Teaching: AREN 2110 Thermodynamics; CVEN 4830 Senior Design Projects, CVEN 4833 Residential Water Reuse Research: Biological Treatment of Contaminants in Water and Wastes, Water Reuse

Email: joann.silverstein@colorado.edu, phone: 303 492 7211, office: ECOT 456

**Scott Summers**, Professor, Civil, Environmental, and Architectural Engineering, EVEN Director

Education: B.S., M.S., University of Cincinnati (1980, 1982), Ph.D., Stanford University (1986)

Teaching: EVEN 1000 Intro to Environmental Engineering, CVEN 3424 Water and Wastewater Treatment, CVEN 5464 Env. Engineering Processes

Research: Drinking Water Quality and Treatment, Disinfection By-Products, Natural Organic Matter, Water Treatment for Developing Communities

Email: r.summers@colorado.edu, phone: 303 492 6644, office: ECST 202 – SEEC S295A

**Marina Vance**, Assistant Professor, Mechanical Engineering

Education: B.S., M.S., Universidade Federal de Santa Catarina (2004, 2008), Ph.D. Virginia Tech (2012)

Teaching: MCEN 5228 Nanotechnology for Environmental Sustainability, MCEN 4045 and MCEN 4085 Mechanical Engineering Design Project 1 and 2, MCEN 4131 Air Pollution Control

Email: Marina.Vance@colorado.edu

**Michael Walker**, Instructor, Civil Environmental, and Architectural Engineering

Education: B.S., University of Illinois at Urbana-Champaign (2004), Ph.D., Illinois Institute of Technology (2012)

Teaching: MCEN 3032 Thermodynamics 2, EVEN 4434/5434 Environmental Engineering Design, EVEN 4834 Energy: Generation, Environmental Impacts and Renewable Solutions, GEEN 1400 First-Year Engineering Projects

Email: Michael.E.Walker@colorado.edu, Phone: 303 735 7336, Office: ECES 103A

**Jeff Writer**, Instructor, CU Teach, Civil, Environmental, and Architectural Engineering

Education: B.A., Brown University (1987) M.S., Teacher Certification, Ph.D. University of Colorado (1992, 1997, 2010)

Teaching: EDUC 2020 Step 1, EDUC 2030 Step 2, EDUC 5385 Project Based Instruction, EDUC 4833/5833 Teaching and Learning Earth Systems, CVEN 3414 Fundamentals of Environmental Engineering, CVEN 5323 Applied Stream Ecology, CVEN 3434 Applied Ecology

Research: Contaminant fate and transport in surface waters, ecosystem/infrastructure interactions

Email: jeffrey.writer@colorado.edu, phone: 720-544-1680, Office: EDUC 344

**Wendy Young** Instructor, Chemical and Biological Engineering

Education: B.S. University of Notre Dame (1996), M.S., PhD University of Colorado (1998, 2002)

Teaching: CHEN 3220 Separations and Mass Transfer, CHEN 3130 Undergraduate Lab I, CHEN 4130 Undergraduate Lab II, CHEN 1300 Intro to Chemical Engineering, CHEN 4090 Undergraduate Seminar

Email:wendy.young@colorado.edu, phone: 303 492 8721, office: JSCBB D1B24

## Forms and Appendices

These **forms** can be found on the College of Engineering and Applied Science's Advising website at

[www.colorado.edu/engineering-advising/forms](http://www.colorado.edu/engineering-advising/forms):

- Change of Major (including adding additional major or minor)
- Concurrent BS/MS Application
- Course Schedule Approval (for students on academic probation)
- Incomplete Grade
- Independent Study
- Minor Completion (for engineering minors)
- Petition

In addition to the forms listed above, the following forms may be obtained from the Academic Advisor:

- Advising Evaluation Form
- Degree Requirements Worksheet (see also following pages)
- Senior Thesis Proposal Forms
- Special Action Form
- Special Option Selection Proposal
- Transfer Credit Appeal

These **appendices** are included here in the following pages:

- Technical Elective Suggestions
- Useful Websites



2017 EVEN Senior Design Team wins 1st place at ACRP Competition

## Technical Elective Courses

Any of the courses listed in the options are good technical electives. Other approved Technical Elective Courses for EVEN are listed at this website: [www.colorado.edu/even/sites/default/files/attached-files/technical\\_electives\\_2016-17\\_6-8-16.pdf](http://www.colorado.edu/even/sites/default/files/attached-files/technical_electives_2016-17_6-8-16.pdf). If a course is not on this list, you may request approval on a petition form. Honors sections of the courses listed below will also be accepted.

Some graduate-level classes (5000+) can also be taken as technical electives -- check with your advisor. Note, however, that prerequisites are not listed in the catalog for graduate courses; instructor's permission may be required.

Courses marked with an asterisk (\*) fulfill the earth sciences technical elective requirement (geology, meteorology or soil science). Courses marked with † will fulfill the air/earth sciences lab/field requirement.

## Useful Websites

**Environmental Engineering Program:** [www.colorado.edu/even/](http://www.colorado.edu/even/)

**College of Engineering and Applied Science:** [www.colorado.edu/engineering/](http://www.colorado.edu/engineering/)

**Academic Support Programs:** <http://www.colorado.edu/engineering/academics/support>

**Active Learning Program:** <http://www.colorado.edu/activelearningprogram/>

**Co-op Program:** [www.colorado.edu/activelearningprogram/professional-learning/cooperative-education-program](http://www.colorado.edu/activelearningprogram/professional-learning/cooperative-education-program)

**Discovery Learning** (includes Discovery Learning Apprenticeship Program, Undergraduate Research Opportunities Program (UROP), Bioscience Undergraduate Research Skills and Training (BURST), Research Experience for Undergraduate (REU)): [www.colorado.edu/activelearningprogram/discovery-learning](http://www.colorado.edu/activelearningprogram/discovery-learning)

**Service Learning** (includes Earn-Learn Apprenticeship Program, Engineering for Developing Communities, Engineers Without Borders, etc): [www.colorado.edu/activelearningprogram/service-learning](http://www.colorado.edu/activelearningprogram/service-learning)

**Professional Learning** (includes internships and co-ops): <http://www.colorado.edu/activelearningprogram/professional-learning>

**Advising Guides (College):** [www.colorado.edu/engineering-advising/get-your-degree/academic-expectations-policies](http://www.colorado.edu/engineering-advising/get-your-degree/academic-expectations-policies)

**BOLD Center, Academic Support:** [www.colorado.edu/bold/](http://www.colorado.edu/bold/)

**Career Services:** [www.colorado.edu/career/](http://www.colorado.edu/career/)

**Catalog, University of Colorado at Boulder:** [www.colorado.edu/catalog/2016-17/](http://www.colorado.edu/catalog/2016-17/)

**Engineering for Developing Communities (EDC):** [www.colorado.edu/mcedc/](http://www.colorado.edu/mcedc/)

**Engineering Honors Program:** [www.cuhonorsengineering.com](http://www.cuhonorsengineering.com)

**FE Exam:** National Council of Examiners for Engineering and Surveying [www.ncees.org/](http://www.ncees.org/)

**State of Colorado Board of Licensure:** <https://www.colorado.gov/pacific/dora/AES>

**Forms (College):** Petition form, Change of Major Form, etc.): <http://www.colorado.edu/engineering-advising/forms>

**Humanities and Social Sciences Requirements:** [www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-writing-requirements/alphabetic-list](http://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-writing-requirements/alphabetic-list)

**Herbst Program:** [www.colorado.edu/herbst/](http://www.colorado.edu/herbst/)

**International Engineering Certificates:** <http://www.colorado.edu/engineering-international/>

**Minors:** [www.colorado.edu/engineering/academics/guide-degrees-certificates/minors](http://www.colorado.edu/engineering/academics/guide-degrees-certificates/minors) and [www.colorado.edu/leeds/minor-business](http://www.colorado.edu/leeds/minor-business)

**MyCUInfo portal:** [mycuinfo.colorado.edu](http://mycuinfo.colorado.edu)

**Office of the Registrar:** [registrar.colorado.edu/](http://registrar.colorado.edu/)

**Schedule of Courses:** [mycuinfo.colorado.edu](http://mycuinfo.colorado.edu)

**Course listings in .pdf format:** [conted.colorado.edu/programs/access/](http://conted.colorado.edu/programs/access/)

**Student Society for Environmental Engineering:** [www.colorado.edu/even/current-students/undergraduate-studies/seven-society-even](http://www.colorado.edu/even/current-students/undergraduate-studies/seven-society-even)

**Study Abroad:** [abroad.colorado.edu/](http://abroad.colorado.edu/)

**Transfer students, information for:** [www.colorado.edu/admissions/transfer](http://www.colorado.edu/admissions/transfer)

**Transfer Credits:** [www.transferology.com/](http://www.transferology.com/)

**GTPathways curriculum:** [higher.ed.colorado.gov/Academics/Transfers/qtPathways/default.html](http://higher.ed.colorado.gov/Academics/Transfers/qtPathways/default.html)

# Degree Requirements Worksheet – EVEN BS Degree 2017-2018

Student Name: \_\_\_\_\_ Student#: \_\_\_\_\_

Faculty Advisor: \_\_\_\_\_ Catalog year: \_\_\_\_\_ Major year: \_\_\_\_\_

**Required Courses**

| course no.                    | course name                             | credits   | course taken (if different)   | grade | term  |
|-------------------------------|---|---|-------------------------------|-------|-------|
| <i>Engineering (53 hours)</i> |   |   |                               |       |       |
| EVEN 1000                     | Intro to Environmental Engineering      | 1   | _____                         | _____ | _____ |
| CHEN 1310                     | Intro to Engineering Computing          | 3   | _____                         | _____ | _____ |
| GEEN 1400                     | Engineering Projects                    | 3   | _____                         | _____ | _____ |
| CVEN 3414                     | Fundamentals of Environmental Engr      | 3   | _____                         | _____ | _____ |
| CHEN 2120                     | Chem Engr Matl Energy Balances          | 3   | _____                         | _____ | _____ |
| 1                             | Solid Mechanics                         | 3   | _____                         | _____ | _____ |
| EVEN 4404                     | Water Chemistry                         | 3   | _____                         | _____ | _____ |
| EVEN 4414                     | Water Chemistry Lab                     | 1   | _____                         | _____ | _____ |
| 2                             | Engineering Economics                   | 3   | _____                         | _____ | _____ |
| 3                             | Fluid Mechanics                         | 3   | _____                         | _____ | _____ |
| 4                             | Thermodynamics                          | 3   | _____                         | _____ | _____ |
| EVEN 4424                     | Environmental Organic Chemistry         | 3   | _____                         | _____ | _____ |
| 5                             | Heat Transfer                           | 3   | _____                         | _____ | _____ |
| EVEN 4484                     | Intro to Environmental Microbiology     | 3   | _____                         | _____ | _____ |
| MCEN 4131                     | Air Pollution Control                   | 3   | _____                         | _____ | _____ |
| 6                             | Probability and Statistics              | 3   | _____                         | _____ | _____ |
| CVEN 4333                     | Engineering Hydrology                   | 3   | _____                         | _____ | _____ |
| EVEN 4464                     | Environmental Engineering Processes     | 3   | _____                         | _____ | _____ |
| EVEN 4434                     | Environmental Engineering Design        | 4   | _____                         | _____ | _____ |
|                               |   | <input style="width: 50px; height: 20px;" type="text"/> | <b>Engineering Total (53)</b> |       |       |
| <i>Mathematics (16 hours)</i> |   |   |                               |       |       |
| APPM 1350                     | Calculus 1 for Engineers                | 4   | _____                         | _____ | _____ |
| APPM 1360                     | Calculus 2 for Engineers                | 4   | _____                         | _____ | _____ |
| APPM 2350                     | Calculus 3 for Engineers                | 4   | _____                         | _____ | _____ |
| APPM 2360                     | Intro Diff Eqns w Linear Algebra        | 4   | _____                         | _____ | _____ |
|                               |   | <input style="width: 50px; height: 20px;" type="text"/> | <b>Mathematics Total (16)</b> |       |       |
| <i>Sciences (17 hours)</i>    |   |   |                               |       |       |
| CHEN 1211                     | General Chemistry                       | 4   | _____                         | _____ | _____ |
| CHEM 1221                     | General Chemistry Laboratory            | 1   | _____                         | _____ | _____ |
| PHYS 1110                     | General Physics 1                       | 4   | _____                         | _____ | _____ |
| PHYS 1120                     | General Physics 2                       | 4   | _____                         | _____ | _____ |
| PHYS 1140                     | Experimental Physics 1                  | 1   | _____                         | _____ | _____ |
| EVEN 3550                     | Sustainability Principles for Engineers | 3   | _____                         | _____ | _____ |
|                               |   | <input style="width: 50px; height: 20px;" type="text"/> | <b>Sciences Total (17)</b>    |       |       |

<sup>1</sup> Solid Mechanics options: CVEN 2121 Analytical Mechanics, GEEN 2851 Statics for Engrs, MCEN 2023 Statics and Structures.  
<sup>2</sup> Engineering Economics options: CVEN 4147 Civil Engineering Systems (F), EMEN 4100 Business Methods and Economics for Engineers  
<sup>3</sup> Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics, CVEN 3313 Fluid Mechanics, GEEN 3853 Fluid Mechanics for Engineers, MCEN 3021 Fluid Mechanics.  
<sup>4</sup> Thermodynamics options: AREN 2110 Thermodynamics, CHEN 3320 Chemical Engineering Thermodynamics, GEEN 3852 Thermodynamics for Engineers, MCEN 3012 Thermodynamics.  
<sup>5</sup> Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer, MCEN 3022 Heat Transfer.  
<sup>6</sup> Probability & Statistics options: APPM 4570 Statistical Methods, CHEN 3010 Applied Data Analysis, CVEN 3227 Probability, Statistics, & Decision

# Degree Requirements Worksheet – EVEN BS Degree 2017-2018

## Elective Courses

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| course no.  | course name   | credits | course taken | grade | term  |
|---|---|---------|--------------|-------|-------|
| Humanities & Social Sciences Electives (18 hours, 6 hours upper division) |   |         |              |       |       |
|   | H&SS (lower or upper division)  | _____   | _____        | _____ | _____ |
|   | H&SS (lower or upper division)  | _____   | _____        | _____ | _____ |
|   | H&SS (lower or upper division)  | _____   | _____        | _____ | _____ |
|   | H&SS (upper division)   | _____   | _____        | _____ | _____ |
|   | H&SS (upper division)   | _____   | _____        | _____ | _____ |
| 7   | Required Writing Course   | _____   | _____        | _____ | _____ |
|   | <input style="width: 50px; height: 20px;" type="text"/> H&SS Total (18)         |         |              |       |       |
| Environmental Engineering TE courses (9 hours)                            |   |         |              |       |       |
| 8   | Enviro Eng Design TE  | _____   | _____        | _____ | _____ |
|   | Enviro Eng TE I   | _____   | _____        | _____ | _____ |
|   | Enviro Eng TE II  | _____   | _____        | _____ | _____ |
|   | <input style="width: 50px; height: 20px;" type="text"/> Enviro Eng TE Total (9) |         |              |       |       |
| Technical Electives (9 hours: 6 hours upper division, 3 Earth Science)    |   |         |              |       |       |
| 9   | Tech (lower or upper division)  | _____   | _____        | _____ | _____ |
|   | Tech (upper division)   | _____   | _____        | _____ | _____ |
|   | Tech (upper division)   | _____   | _____        | _____ | _____ |
| 10  | Air/Earth Lab/Field Course  | _____   | _____        | _____ | _____ |
|   | <input style="width: 50px; height: 20px;" type="text"/> (12)                    |         |              |       |       |
|   | Free Elective (2 hours)   | _____   | _____        | _____ | _____ |
|   | <input style="width: 50px; height: 20px;" type="text"/> (2)                     |         |              |       |       |

**Credit hour Total:**

**(128) Grade Point Average:**

**MAPS Complete:**

**Date: Date:**

**FE Exam:**

**Date:**

**Final Check:**



<sup>7</sup> Writing course: HUEN 1010 Humanities for Engineers: The Human Quest, HUEN 3100 Advanced Humanities for Engineers: The Human Quest Continues, WRTG 3030 Writing on Science and Society, WRTG 3035 Technical Communication and Design, or PHYS 3050 Writing in Physics.

<sup>8</sup> Consult Environmental Engineering (EVEN) Degree Guidelines for lists of Option courses.

<sup>9</sup> Technical Electives: Three technical elective credits may be lower division (1000-, 2000-level). Three technical elective credits must be in the earth sciences, either lower or upper division (eligible departments and programs include ATOC, CVEN, GEOL, and GEOG). Independent studies or senior thesis may be completed as technical electives for up to 6 credits total, 3 credits per semester.

<sup>10</sup> Air/Earth Lab/Field course: a 3(+) credit course with a significant laboratory or field component focusing on air quality or earth science. If less than 3 credits, the difference is required as an upper division technical elective or accompanying lecture.

Options: ATOC 1050/1070 Weather and the Atmosphere Lab/Lecture or ATOC 1070 and Upper Tech Elec., CVEN 3708 Geotechnical Engineering, EVEN 4100 Environmental Sampling, GEOL 1030 Intro to Geology Lab (1), GEOL 2700 Intro to Field Geology (2), GEOL 3010 Intro to Mineralogy, GEOL 4716 Environmental Field Geochemistry (2) Can NOT be the same T.E. used for Earth Science T.E.

| SEM  | CR | EVEN BS Degree: Block Diagram 2017-18   |  |   |   |   |  |
|------|----|---|--|---|---|---|--|
| Spr  | 16 | Enviro Eng TE II -3-<br>or<br>Technical Elective II -3-<br>*  | MCEN 4131 -3-<br>Air Pollution Control<br>P: fluid mechanics & Thermo<br>#                         | CVEN 4333 -3-<br>Engineering Hydrology<br>P: Fluids<br>C: Prob & Stat           | EVEN 4434 -4-<br>Environmental Engineering Design<br>P: CVEN 3414<br>#                    | Technical Elective III -3-<br>or<br>Senior thesis<br>*                        |  |
| Fall | 17 | Enviro Eng TE I -3-   | Air or Earth Science Lab<br>or<br>Field course -3-   | Free Elective -2-   | EVEN 4464 -3-<br>Env Engrg Processes<br>P: CVEN3414 & fluids<br>#                         | Technical Elective II -3-<br>or Enviro Eng TE II -3-<br>or Senior thesis<br>* | H&SS<br>Elective V -3-<br>upper division   |
| Spr  | 15 | Enviro Eng Design TE -3-  | EVEN 4424 -3-<br>Env Organic Chemistry<br>P:CHEN1211<br>#  | Probability & Statistics -3-<br>CHEN:P:CHEN1310&<br>APPM2360                    | EVEN 4484 -3-<br>Intro to Environ Microbiology<br>P:CHEN1211<br>#                         | Heat Transfer -3-<br>MCEN:P: Thermo/fluids<br>CHEN: P: fluids                 |  |
| Fall | 16 | Engineering Economics -3-   | EVEN 4404 -3-<br>Water Chemistry<br>EVEN 4414 -1-<br>Water Chem Lab<br>P: CHEN1211 & CVEN3414<br># |   | EVEN 3550 -3-<br>Sustainability Principles for Engineers<br><br>C: CVEN 3414<br>#         | Thermodynamics -3-<br>MCEN: P: Calc 3<br>AREN: P: PHYS 1110<br>C: Calc 2      | Writing Course -3-<br>(Jr. standing)       |
| Spr  | 16 | APPM 2360 -4-<br>Introduction to Differential Equations & Linear Algebra<br>P: APPM 1360 or MATH 2300 | Fluid Mechanics -3-<br>CVEN P: solids<br>MCEN P: solids C: calc 3                                  |   | CVEN 3414 -3-<br>Fundamentals of Env. Engineering<br>P: CHEN 1211, CHEM 1221, & APPM 1360 | CHEN 2120 -3-<br>Material and Energy Balances<br>P: CHEM1211, CHEN 1310<br>** | H&SS<br>Elective IV -3-<br>upper division  |
| Fall | 15 | APPM 2350 -4-<br>Calculus III for Engineers<br>P: APPM 1360 or MATH 2300                              | PHYS 1120 -4-<br>PHYS 1140 -1-<br>Gen.Phys/Lab<br>P: PHYS 1110 & C: MATH 2300 or APPM 1360         | Solid Mechanics course -3-<br>CVEN:P: PHYS 1110 & C: Calc III; MCEN: P: calc II |   |   | H&SS<br>Elective III -3-<br>lower division |
| Spr  | 17 | APPM 1360 -4-<br>Calculus II for Engineers<br>P: APPM 1350 or MATH 1300                               | PHYS 1110 -4-<br>Gen. Physics I<br>P/C: APPM 1350 or MATH 1300                                     |   | CHEN 1310 -3-<br>Introduction to Computing<br>P/C: APPM 1350 or MATH 1300                 | Technical Elective I -3-<br>*   | H&SS<br>Elective II -3-<br>lower division  |
| Fall | 16 | APPM 1350 -4-<br>Calculus I for Engineers   | CHEN 1211 -4-<br>Gen Chem for Engineers<br>C: CHEN 1221 \$   | CHEM 1221 -1-<br>General Chem Lab<br>C: CHEN 1211 \$                            | GEEN 1400 -3-<br>Engineering Projects   | EVEN 1000 -1-<br>Introduction to Environmental Engineering<br>#               | H&SS<br>Elective I -3-<br>lower division   |

# - Courses marked thus are offered only in SEMESTER shown.

\$ - CHEN 1211 & CHEM 1221 must be taken concurrently.

() - Prerequisite or Co-requisite required before taking course listed.

\*\*CHEN 2120-A grade of C or higher is needed to continue into CHEN courses.

Solid Mechanics options: CVEN 2121 Analytic Mechanics I (F,S; Phys1110, co-req APPM GEEN 2851 Statics for Engr (PHYS 1110, APPM 2350), MCEN 2023 Statics & Structures (F; APPM 1360);

Fluid Mechanics options: CVEN 3313 Theoretical Fluid Mechanics (S; Solid Mechanics); MCEN 3021 Fluid Mechanics (F,S; APPM 2360, Solid Mech), CHEN 3200 Chem Engr Fluid Mechanics (S; APPM2350/2360, CHEN2120/MCEN2023), GEEN 3853 Fluid Mech for Engrs (sum, APPM 2350/2360, GEEN 1300)

Thermodynamics options: AREN 2110 Thermo (F,S APPM1360, PHYS1110), CHEN 3320 Chem Eng Thermo (F; reqd chem proc option; CHEN2120, CHEM4521); GEEN 3852 Thermo for Engrs (sum, APPM2350), MCEN 3012 Thermodynamics (F,S reqd air quality option; APPM 2350)

Heat Transfer options: CHEN3210 Chem Eng Heat Transfer (F; Fluids, MCEN 3022 Heat Transfer (F,S; Thermo, Fluids)

\*Tech electives: 3 cr can be lower division, others must be 3000 or 4000 level; one tech elective (3cr) must relate to earth sciences such as geology courses, engineering geology, CVEN Geotech I, etc.

Air/Earth Lab Field course such as: ATOC 1070 Weather & Atmos Lab, CVEN 3708 Geotech Eng, EVEN 4100 Env Sampling, GEOG 4411 Methods of Soil Analysis, GEOL 2350; 2700-2 Intro to Field Geol, GEOL 3010 Intro to Mineralogy, GEOL4716 Env Field Geol. If course is less than 3 credits, remaining credits must be upper division tech electives.

Engineering Economics options: CVEN 4147 Civil Engineering Systems (F), EMEN 4100 Business Methods and Economics for Engineers

Probability and Statistics options: APPM 4570 Statistical Methods (F,S; APPM 1360), CHEN 3010 Appl Data Analysis (F, CHEN1310, APPM 2360), CVEN 3227 Probability, Statistics, & Decision (S)

Writing Course: GEEN 3000 Prof Comm Engrs, HUEN 3100 Humanities for Engrs, WRTG 3030 Writing Sci & Society, WRTG 3035 Tech Comm & Design; PHYS 3050 Wrtg for Phys

Key: P: Prereq ; C: Co-req MCEN courses require a C grade or higher for all prereq's.