Environmental Engineering (EVEN) Degree Guidelines

Academic Year 2008-2009

College of Engineering and Applied Science

University of Colorado at Boulder

Environmental Engineering Program

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Contents

1. Introduction to Environmental Engineering

The *Environmental Engineering (EVEN) Degree Guidelines* provide an outline of the curriculum and policies of the Environmental Engineering (EVEN) degrees offered by the College of Engineering and Applied Science of the University of Colorado at Boulder. These guidelines are written primarily for the Environmental Engineering students and faculty advisors. 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 (http://www.colorado.edu/engineering/even/evenbs.htm).

General curriculum and 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://ecadw.colorado.edu/engineering/students/advising.htm). Similar information on academic support programs, advising, and registration is available on the web at the College's Undergraduate Student Services web page (http://ecadw.colorado.edu/engineering/students/undergraduate.htm).

Information on courses offered each semester is available in the *Course Listings* and the *University of Colorado at Boulder Catalog* published by the University of Colorado. Course scheduling information for the coming semester and the past two or three semesters is available on University's Schedule Planner web page (http://plus.colorado.edu/planner/) and through CUConnect (https://cuconnect.colorado.edu). A .pdf file of course listings, alphabetical by college, can be found on the registrar's website: http://registrar.colorado.edu/ (This document is not updated past its "publication date", however, so check the Schedule Planner for the most recent information.) Course descriptions are available in the University's Course Catalog (http://www.colorado.edu/catalog/catalog08-09/).

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 and transfer of infectious diseases, human health and ecological risk management, prevention of pollution through product or process design, and renewable and sustainable energy sources.

The Engineering Center at the University of Colorado at Boulder

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 blended 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 committee was headed by Prof. John Daily of Mechanical Engineering. The degree program was intended to supplement environmental engineering options that were offered through the Departments of Chemical and Biological Engineering and Civil, Environmental, and Architectural Engineering (the Department of Mechanical Engineering now offers an environmental engineering option as well).

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 (CCHE), and the new EVEN BS degree program was approved in the spring of 1998. The first Director of the Environmental Engineering Program was Prof. Jana Milford of Mechanical Engineering. 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).

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

In approving the new degree, CCHE relied on the College's intent to deliver the EVEN BS degree using existing courses and faculty. To this end, the program is administered by the College, and operates through the participation of affiliated faculty from Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering. The College provides support for a faculty Director (currently Prof. Angela Bielefeldt of Civil, Environmental, and Architectural Engineering), a Program Coordinator, and teaching support for courses to supplement the EVEN curriculum. The four 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.

During the 2002-2003 academic year, the Environmental Engineering Program applied for accreditation of the EVEN BS degree with the Accreditation Board of Engineering and Technology (ABET). The application consisted of a detailed Self-Study Report and a visit by three ABET examiners. The ABET examiners were thoroughly satisfied with the EVEN BS degree and 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. Another ABET accreditation review in 2005 resulted in a few curriculum revisions, including the addition of a laboratory or field course related to air or land, as required by the ABET Program Criteria.

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 **educational objectives** of the EVEN BS degree are to produce students who reach the following achievements three to five years after graduation:

1. EVEN graduates have become established in professional careers and earned advanced degrees;
2. EVEN graduates have applied multidisciplinary approaches to manage the unique challenges and balance the competing social, political, economic, and technical goals of environmental problems and solutions; and
3. EVEN graduates have served the needs of our society and protected the future of our planet in an ethical manner.

1.4. List of Program Outcomes

A list of program outcomes for EVEN graduates was developed which satisfies the requirements of ABET in the *Criteria for Accrediting Engineering Programs* for general engineering programs (ABET Criterion 3) and for environmental engineering programs (Criterion 8) as developed by the American Academy of Environmental Engineers (AAEE). 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, 2004).

The Environmental Engineering Program demonstrates that

i. EVEN graduates have sufficient knowledge of engineering, mathematics, and science fundamentals to succeed in environmental engineering practice or advanced degrees; ii. EVEN graduates have sufficient knowledge of advanced environmental engineering applications and complementary natural sciences to succeed in environmental engineering practice or advanced degrees; iii. EVEN graduates have sufficient knowledge of engineering approaches to problem solving (hypothesis, design, testing; team work) to succeed in environmental engineering practice or advanced degrees; iv. EVEN graduates have sufficient knowledge of basic engineering skills and tools (computer, laboratory, and field) to succeed in environmental engineering practice or advanced degrees; v. EVEN graduates have adequate writing and oral presentation skills to succeed in environmental engineering practice or advanced degrees; vi. EVEN graduates have adequate understanding of the social, economic, political, and ethical context of environmental problems and solutions; vii. EVEN graduates have adequate opportunity to include service at the local, state, national, or global levels as an important part of their environmental engineering education; and viii. EVEN graduates will recognize the importance of life-long learning by seeking advanced degrees and pursuing continuing education.	**Outcomes**

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, graduating seniors, and alumni via written surveys helps 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 Bachelors of Science degree in Environmental Engineering (EVEN) 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, geology, and the arts and humanities. 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 culled from Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering. The curriculum also includes three Option courses and four technical elective courses. The three Option courses represent an area of specialization in environmental engineering selected by the student beginning in the third year. The curriculum includes six sets of prescribed Option courses:

- Air Quality
- Applied Ecology
- Chemical Processing
- Energy
- Environmental Remediation
- Water Resources and Treatment

In addition to these prescribed Options, students may also formulate their own sequence of Option courses (referred to as a "Special Option") representing an area of specialization not included in the six sets of Option courses listed above. This selection must be done by petition to the Environmental Engineering Program. Examples of special option topics include Energy & Industrial Monitoring, Remediation & Ecology, and Engineering for Developing Communities (EDC; see program website at: http://www.edc-cu.org/).

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 (see: http://engineering.colorado.edu/activelearning/discovery.htm), or as undergraduate research assistants in sponsored research programs.

2.1.2. Curriculum for EVEN BS Degree

The following section contains the curriculum table 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 acceptable 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 they started the program; therefore, students should keep a copy of the *Environmental Engineering (EVEN) Degree Guidelines* for the academic year they start the program. An archive of the Guidelines is retained on the Program's web site (http://www.colorado.edu/engineering/even/evenbs.htm). 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.

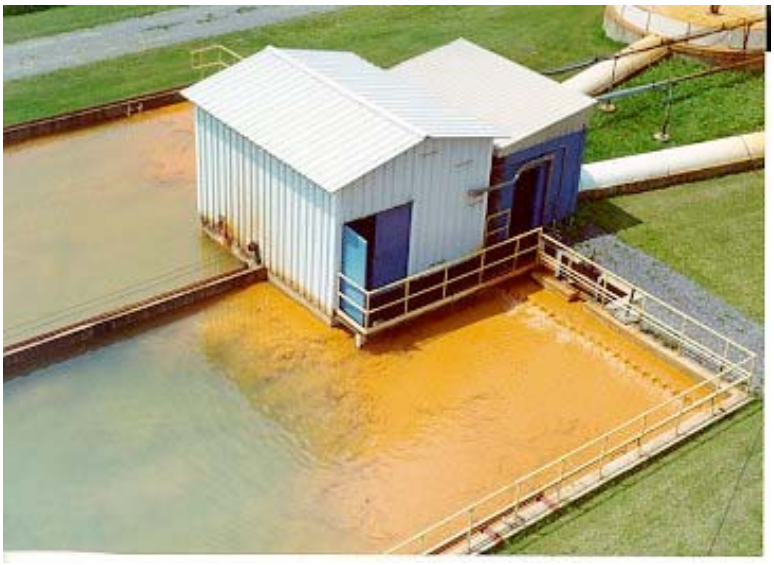
The curriculum below shows the recommended sequence of courses. Courses marked with an asterisk (*) are offered only in the semester shown. Other courses are offered in both semesters. For example, the required course in Environmental Microbiology (third-year spring in the EVEN BS curriculum) may be taken in another semester (provided that all prerequisite and co-requisite course requirements are met) because Environmental Microbiology is not required by a course following it in the curriculum schedule. The air or earth sciences lab or field course (fourth year spring in the curriculum) 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 different engineering departments. Students may choose a course from any of the approved options for each requirement; however, students

should evaluate these choices carefully depending on their major interest in environmental engineering. For example, a student interested in the Air Quality Option might want to take the Mechanical Engineering courses for Solid Mechanics, Fluid Mechanics, Thermodynamics, and Heat Transfer. A student interested in the Chemical Processing Option would do best to choose Chemical Engineering courses (in fact, CHEN 3320 Chemical Engineering Thermodynamics is required for some of the Chemical Processing Option courses).

For certain courses in the EVEN BS degree curriculum, students may encounter problems and concerns about prerequisite and co-requisite course requirements not being met. There is no need for concern; the Environmental Engineering Program has consulted in detail with the departments and faculty offering these courses and has gained assurance that the sequence of courses in the EVEN curriculum is appropriate for engineering students.

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



A settling pond for the treatment of acid mine drainage.

EVEN BS Degree, 2008-2009 Academic Year

Fall, First Year		Spring, First Year	
APPM 1350 Calculus 1 for Engineers	4	APPM 1360 Calculus 2 for Engineers	4
CHEN 1211 General Chemistry for Engineers	3	GEEN 1400 Engineering Projects	3
CHEM 1221 General Chemistry Laboratory	2	PHYS 1110 General Physics 1	4
EVEN 1000 Introduction to Environmental Engineering (*)	1	Technical Elective I [1]	3
GEEN 1300 Introduction to Engineering Computing	3	H&SS Elective II [2]	3
H&SS Elective I [2]	3		
	16		**17**

Fall, Second Year		Spring, Second Year	
APPM 2350 Calculus 3 for Engineers	4	APPM 2360 Intro Differential Eqns with Linear Algebra	4
CVEN 3414 Fundamentals of Environmental Engineering (*)	3	CHEM 4521 Physical Chemistry for Engineers (*)	3
PHYS 1120 General Physics 2	4	CHEN 2120 Material and Energy Balances	3
PHYS 1140 Experimental Physics 1	1	Solid Mechanics [3]	3
H&SS Elective III [2]	3	H&SS Elective IV [2]	3
	15		**16**

Fall, Third Year		Spring, Third Year	
CVEN 3454 Water Chemistry(*)	4	CVEN 4424 Environmental Organic Chemistry (*)	3
Fluid Mechanics [4]	3	CVEN 4484 Introduction to Environmental Microbiology (*)	3
Thermodynamics [5]	3	MCEN 4131 Air Pollution Control (*)	3
Engineering Economics [6]	3	Heat Transfer [7]	3
Required Communication Course [8]	3	Probability and Statistics [9] or Option Course I [10]	3
	16		**15**

Fall, Fourth Year		Spring, Fourth Year	
CVEN 4444 (5834) Environmental Engineering Processes (*)	3	CVEN 4333 Engineering Hydrology (*)	3
H&SS Elective V [2]	3	CVEN 4434 Environmental Engineering Design (*)	3
Option Course I [10] or Probability and Statistics [9]	3	Air or Earth Science Laboratory/Field Course [11]	3
Option Course II [10]	3	Option Course III [10]	3
Technical Elective II [1]	3	Technical Elective IV [1]/Senior Thesis [12]	3
Technical Elective III [1]/Senior Thesis [12]	3		
	18		**15**

* Only offered in the semester shown (not including summer offerings). **Total Credit Hours 128**

[11]A total of 12 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/senior thesis (EVEN 4840) may be completed as technical electives for up to 6 credits.

[2]A total of 18 credit hours of humanities and social sciences (H&SS) electives is required. At least nine hours must be at the upper division level. Three hours must be a Required Communication Course[8] at the 3000-level or above.

[3] Solid Mechanics options: CVEN 2121 Analytical Mechanics (F,S), GEEN 3851 Statics for Engineers (Sum), or MCEN 2023 Statics and Structures (F).

[4] Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics (S), CVEN 3313 Theoretical Fluid Mechanics (S), GEEN 3853 Fluid Mechanics for Engineers (Sum), or MCEN 3021 Fluid Mechanics (F).

[5] Thermodynamics options: AREN 2110 Thermodynamics (F), CHEN 3320 Chemical Engineering Thermodynamics (F; required for Chemical Processing Option), GEEN 3852 Thermodynamics for Engineers (Sum), or MCEN 3012 Thermodynamics (F, required for Air Quality Option).

[6] Engineering Economics options: EMEN 4100 Business Methods and Economics for Engineers (F), CVEN 4147 Engineering Economy and System Design, or EVEN 4830 Technoeconomic Analysis for Environmental Engineering.

[7] Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer (F) or MCEN 3022 Heat Transfer (S).

[8] Communications: WRTG 3030 Writing on Science and Society (F,S), WRTG 3035 Technical Communication and Design (F, S), GEEN 3000 Professional Communications for Engineers, HUEN 3100 Humanities for Engineers 1 (F,S), or PHYS 3050 Writing in Physics: Problem Solving and Rhetoric (F).

[9] Probability and Statistics options: APPM 4570 Statistical Methods (F,S), CHEN 3010 Applied Data Analysis (F), CVEN 3227 Probability, Statistics, and Decision. (S)

[10] Option courses are specified on the following page.

[11] Air or Earth Science Lab/Field Course: A 3 credit hour course with a significant laboratory or field component related to air quality or earth science. If course is less than 3 credits, the difference is required as an upper division technical elective. Options: ATOC1070 Weather and the Atmosphere Lab, CVEN3708 Geotechnical Engineering, EVEN4100 Environ. Sampling & Analysis, GEOG4411 Methods of Soil Analysis (every other F), GEOL1030 Intro to Geology 1 Lab, GEOL2700 Intro to Field Geology, GEOL3010 Intro to Mineralogy (F), GEOL4716 Environmental Field Geochemistry (S)

[12] Senior Thesis: a senior thesis can be completed with faculty approval if Technical Electives III and IV are taken as independent studies on a single research topic.

Beginning in the spring of their third year, students must select an Option, an area of specialization in environmental engineering. For each option, a total of 9 credit hours of option courses is required. Students may choose from the lists of possible Option courses listed below. Note that not all of the courses listed are offered every year, denoted by I*.

Air Quality Option

- ATOC 3500 Air Chemistry and Pollution (3 credit hours, F; prerequisite: two semesters chemistry)
- ATOC 4720 Introduction to Atmospheric Physics and Dynamics (3 credit hours, I*; prereq: APPM 1350, PHYS 1110)
- CHEM 4541 Physical Chemistry Lab (2 credit hours, I*; prerequisite or co-requisite: CHEM 4521 or CHEM 4531)
- MCEN 4042 Thermal Systems Design (3 credit hours, S; prerequisite: MCEN 3022 Heat Transfer or equivalent)
- MCEN 4141 Indoor Air Pollution (3 credit hours, I*; prerequisites: MCEN 3021 Fluids and 3022 Heat Transfer, or equivalents)
- MCEN 4152 Introduction to Combustion (3 credit hours, I*; prerequisite: MCEN 3012, recommended: MCEN 3021-3022)
- MCEN 4162 Energy Conversion (3 credit hours, contact Mechanical Engineering Department; prerequisite: MCEN 3012)
- MCEN 4228 Environmental Modeling (3 credit hours, F; prerequisites: chemistry, fluid mechanics, computer programming)

Applied Ecology Option

- CVEN 3434 Intro to Applied Ecology (required for this option, 3 credit hours, S; prerequisites: CHEN 1211-1221 or CHEM 1111)
- EBIO 2040 Principles of Ecology (4 credit hours; prerequisites: CVEN 3434 with instructor consent or EBIO 1040 & 1050 or EBIO 1240)
- EBIO 3270 Ecosystem Ecology (3 credit hours, S; prerequisites: CVEN 3434 or EBIO 1240, EBIO 2040 or EBIO 3020†)
- EBIO 4020 Stream Biology (3 credit hours, F; prerequisites: CVEN 3434 or EBIO 1240, EBIO 2040 †)
- EBIO 4030 Limnology (3 credit hours, S; prerequisites: CVEN 3434 or EBIO 1240, EBIO 2040 †)
- EBIO/GEOL/ENVS 4160 Introduction to Biogeochemistry (3 credit hours; prerequisite: CHEM 1011 or higher, EBIO 3270 or GEOL 3320)
- GEOG 4311 Watershed Biogeochemistry (2 credit hours, S; prerequisite: GEOG 1011, GEOG 3511)

Chemical Processing Option

- CHEM 3311 Organic Chemistry 1 (4 credit hours; prerequisite: CHEN 1211 or equiv.; co-requisite: CHEM 3321 or 3361)
- CHEM 3331 Organic Chemistry 2 (4 credit hours; prerequisite CHEM 3311 or 3351; co-requisite CHEM 3341 or 3381)
- CHEN 3220 Chemical Engineering Separations and Mass Transfer (required for this option, 3 credit hours, S; prerequisites: CHEN 3200, CHEN 3320; co-requisite: CHEN 3210 or MCEN 3022; or equivalents)
- CHEN 4330 Chemical Engineering Reaction Kinetics (required for this option, 3 credit hours, S; prerequisites: CHEN 3320, CHEN 3210 or MCEN 3022)
- CHEN 4670 Environmental Separations (3 credit hours, every other S; prerequisite: CHEN 2120, senior or graduate)
- CHEN 4680 Environmental Process Engineering (3 credit hours; senior or graduate standing)

Energy Option

- Specific courses to be determined.

Environmental Remediation Option

- CVEN 4353 Groundwater Engineering (3 credit hours, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)
- CVEN 4474 Hazardous and Industrial Waste Management (3 credit hours, F; prerequisite: CVEN 3414)
- EVEN 4100 Environmental Sampling and Analysis (3 credit hours, I*; prerequisites: CVEN 3454, CVEN 4424 or equiv)
- GEOL 3030 Introduction to Hydrogeology (3 credit hours, F; prerequisites: GEOL 1010 or 1060, APPM 1350 or instr consent)
- GEOL 4716 Environmental Field Geochemistry (2 credit hours, S; prerequisites: GEOL 2700, CHEN 1211 †)

Water Resources and Treatment Option

- CVEN 3323 Hydraulic Engineering (3 credit hours, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)
- CVEN 3424 Water and Wastewater Treatment (3 credit hours, S; prerequisite: CVEN 3414)
- CVEN 4323 Water Resource Engineering Design (3 credit hours, I*; prerequisite: statistics, engineering economics)
- CVEN 4343 Open Channel Hydraulics (3 credit hours; prerequisite: CVEN 3313 or equivalent fluid mechanics course)
- CVEN 4353 Groundwater Engineering (3 credit hours, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)
- CVEN 4474 Hazardous and Industrial Waste Management (3 credit hours, F; prerequisite: CVEN 3414)
- CVEN 5393/ECON 6555 Water Resources Development and Management (3 credit hours, F; prerequisite: senior or graduate)
- GEOG 4501 Water Resources and Water Management of the Western U.S. (3 credit hours)
- MCEN 4228 Environmental Modeling (3 credit hours, F; prerequisites: chemistry, fluid mechanics, computer programming)

*I Offered intermittently † or by instructor's consent as arranged by the Environmental Engineering Program

Special Option

Students with unique educational goals may formulate a personalized sequence of three courses (9 credit hours) as the Option sequence. To do so, students must present their Option plan to their faculty advisor and submit a petition to the Environmental Engineering Program for approval. A special option must have a specific, well-thought-out purpose related to your education or career goals (i.e., "scheduling conflict" is not an acceptable reason for a special option.) The "Special Option" petition may be found in the Forms Appendix.

2.2. 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 complete a minimum of 30 additional credit hours above and beyond the larger minimum credit hour requirement. If the requirements of both curricula can be satisfied with fewer than 30 credit hours, the difference can be made up with elective courses.

Of the 30 additional credit hours, dual degree students must complete 24 semester credit hours in courses offered by the secondary academic department or in courses approved in advance by the department as substitutes. Transfer students pursuing double degrees must complete a minimum of 75 semester credit hours as a degree student in the College of Engineering and Applied Science and must satisfy all other stipulations regarding total hours required and approval of all coursework by both departments concerned.

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).

Erik Jorgensen, an EVEN 2005 graduate, working on a solar pond evaporation control system for the U.S. Bureau of Reclamation.

2.3. Concurrent Bachelor of Science / Master of Science Degree

The Environmental Engineering Program is cooperating with the Civil, Environmental, and Architectural Engineering Department to offer concurrent EVEN BS/CVEN MS degrees in a five-year curriculum (currently, this is the only concurrent BS/MS degree that includes the EVEN BS degree). To fit the BS and MS degrees in only five years, students are allowed to count two courses (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 in the graduate programs of either Environmental Engineering or Water Resources Engineering.

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 and enables them to obtain BS and MS degrees in five years.

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 Civil, Environmental, and Architectural Engineering Department. 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 April 30 for admission to the program for the following fall and October 30 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 to remain in the program. 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) or Plan II (course work only) 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 option course (up to 9 credit hours) requirements for the EVEN BS.

Sabre Duren, an EVEN 2002 graduate, measuring stream flow with a pygmy meter for an independent study project.

3. Advising

3.1. Advising Process

Just prior to the registration period for each semester and summer session, students are **required** to meet with their faculty advisors for academic counseling. In the Environmental Engineering Program, members of the faculty engage in academic counseling to promote greater student-faculty interaction. An advising stop remains on each student's record until faculty advising has occurred. Faculty advisors are also available for academic and career counseling beyond the required meetings each semester at the student's request.

A few weeks before each advising period, the Program Coordinator will announce to students and faculty advisors by email the advising period schedule. With this email, an updated version of these *Environmental Engineering (EVEN) Degree Guidelines* and other advising information will be sent.

Students must make an appointment with their faculty advisors during the advising period. Faculty advisors will give meetings with advisees high priority during this time. In preparation for the meeting, students should assemble a proposed course plan for the following semester using these *Environmental Engineering (EVEN) Degree Guidelines* and the course schedule for the following semester, which is available in the Schedule Planner (http://plus.colorado.edu/planner/) or through CUConnect (https://cuconnect.colorado.edu).

During the advising meeting, students must discuss their proposed course plan with their faculty advisors. Faculty advisors will record course selections on the Degree Requirements Worksheet (see Forms Appendix). Faculty advisors will also be available to counsel the students on academic performance, long-term course plans, graduation requirements, career planning, and any other personal issues that affect the student's education. At the conclusion of the meeting, the faculty advisor will sign the student's academic file certifying that advising has been done.

After the advising meeting, students are required to fill out an Advising Evaluation Form (see the Forms Appendix) to provide feedback on the advising process. These forms must be submitted to the Program Coordinator.

Once the Coordinator has received a student's academic file with the signature of the faculty advisor (from the faculty advisor) and the Advising Evaluation Form (from the student), the Coordinator will remove the advising stop to allow the student to register.

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

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 (http://www.colorado.edu/search/). You may arrange to receive official notices also at a non-CU e-mail address of your choice by notifying the Program Coordinator; however, the coordinator will provide this service only as convenience to you. The coordinator will not be responsible for information sent to abandoned e-mail addresses. If you do not think you are receiving official EVEN e-mail correspondence (you should be receiving messages from the program coordinator or program director at least every couple of weeks, probably more often), please contact the program coordinator 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:

Career - includes opportunities that will help advance a student's career, e.g. resumé 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.

Scholarship - includes information on scholarships, grants, other sources of funding, and application deadlines.

Academic Advising or **Advising** - includes advising information, curricular options, registration, academic issues, course information, missing pre-requisites, degree progress, etc.

Graduation - includes information for graduating seniors such as FE exam, senior checkout, senior exit processes, senior survey, etc.

Event - includes upcoming meetings, programs, events, trips, and opportunities for volunteers to participate in various functions

Extracurricular Opportunity - includes information on student societies, clubs, etc.

Deadline - includes anything with a looming deadline to which you should pay special attention

Urgent - this will be used sparingly and will indicate a critical communication

3.3. Academic Records

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

The Environmental Engineering Program Coordinator and faculty advisors 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 contains much useful information, including Advising Guides, policies and forms for specific situations: http://engineering.colorado.edu/students/advising.htm.

Students may also be referred to various College of Engineering and Applied Science and University of Colorado counselors for certain issues. Many of the College's student support services are listed on the College web page (http://ecadw.colorado.edu/engineering/students/undergraduate.htm). At the University 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 (http://www.colorado.edu/careerservices/, 34 Willard Hall, 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/sacs/counseling/, 134 Willard Hall, 303 492 6766)

3.5. Faculty Advisor Assignments

All students in the Environmental Engineering Program will be assigned a faculty advisor. Incoming first-year, change-of-major and transfer students will initially be advised by the Program Director. At the first advising meeting for change-of-major and transfer students, transfer credits will be evaluated and a complete course plan to meet graduation requirements will be formulated. After the initial advising, an attempt will be made to direct students to a faculty advisor whose area of expertise is in line with the student's own interests or option track. Students who have not decided focus areas or options will be assigned to a faculty advisor according to the number of credit hours they have completed toward the EVEN degree. Students may also choose their own advisor from the list below, and may also confer with the program coordinator.

Table 3. Faculty advisor assignments

first-year: ≤32 hours second-year: 32< hours≤64 third-year: (64< hours≤96 fourth-year: >96 hours

option/class	faculty advisor	office	phone	email
first-year, change of major and transfers	Angela Bielefeldt	ECOT 516	492 8433	angela.bielefeldt@colorado.edu
energy	Mike Hannigan	ECME 218	735 5045	michael.hannigan@colorado.edu
water resources, remediation and second-third year	Mark Hernandez	ECOT 515	492 5991	mark.hernandez@colorado.edu
ecology	Diane McKnight	ECOT 543	492 7573 or 492 4687	diane.mcknight@colorado.edu
air quality and second-year	Shelly Miller	ECME 222	492 0587	shelly.miller@colorado.edu
air quality and third-year	Jana Milford	ECME 214	492 5542	jana.milford@colorado.edu
water resources, remediation and fourth-year	Joseph Ryan	ECOT 517	492 0772	joseph.ryan@colorado.edu
water resources and first-year	Scott Summers	ECOT 540	492 1024	r.summers@colorado.edu

4. Academic 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 p.8 and the Appendix). The purpose of these requirements is to ascertain 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. Grades of D+, D, D-, F, IF, IW, P or NC do not satisfy this requirement. If you don't receive a C- or better in a pre-requisite course, you must retake it. A student may repeat through the Course Repetition Policy a maximum of 10 hours of course credit. The original earned grade shall remain permanently on the student's transcript, but will be replaced in the cumulative grade point average (GPA) calculation by the new grade. You must apply to participate in the Course Repetition program; applications are available on-line via CUConnect. For more details, see: http://registrar.colorado.edu/students/registration/course_repetition.html.

Successful completion of prerequisite and co-requisite courses will be monitored for all required courses in the Environmental Engineering curriculum by the Program Coordinator. Students who do not successfully complete (grade below C-) prerequisite and co-requisite courses must retake those courses before advancing in the curriculum. If a student registers for a course without satisfactorily completing prerequisite courses, the Program Coordinator will notify the student that that course must be dropped and, if necessary, will drop the student from the course. Students required to retake courses are strongly urged to consult their faculty advisors before retaking courses to evaluate areas in which successful academic performance can be achieved.

The prerequisite and co-requisite policy applies only to required and option 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, chemistry), that elective course may be taken with the approval of the instructor.

Courses not listed in the curriculum may be used to satisfy prerequisite and co-requisite requirements if transfer credit has been approved or a petition to the Environmental Engineering Program has been approved. Generic College of Engineering and Applied Science petition forms for this purpose may be obtained from the Program Coordinator.

4.2. Transfer Credit

Five different kinds of students transfer into the Environmental Engineering program:

- students changing majors from the College's Open Option major to EVEN
- students changing majors from another of the College's engineering degrees to EVEN
- students changing majors from another College or School in the University of Colorado at Boulder to EVEN
- students changing majors from another campus of the University of Colorado to EVEN
- students transferring from another institution

Susan Bautts, a 2003 EVEN graduate, collects samples of the benthic macroinvertebrate population in an acid mine drainage-affected stream.

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 taken as a regular degree student in the College of Engineering and Applied Science in the University of Colorado at Boulder. More details about the College of Engineering and Applied Science transfer credit policies are available in the Dean's office or online at the following URL on the College of Engineering and Applied Science web page (http://ecadw.colorado.edu/engineering/prospective/transfer_students.htm).

4.2.1. Change of Major: From the College's Open Option to EVEN

The EVEN program accepts the College of Engineering and Applied Science Open Option curriculum as a substitute for its own first-year curriculum. Grades of C- or better must have been achieved for all courses counting for required courses in the EVEN curriculum. Students changing from Open Option to EVEN must complete a change-of-major form for the College. A description of the College's Open Option is available online on the College web page (http://engineering.colorado.edu/students/advising.htm).

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

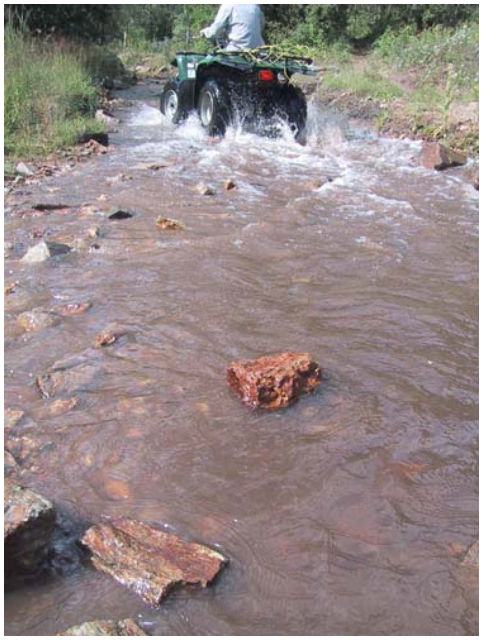
Evaluation of the credit hours earned in another engineering degree curriculum in the College of Engineering and Applied Science for credit in EVEN will be done at the first advising meeting with the EVEN Program Director. Grades of C- or better must have been achieved for all courses counting for required 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.

4.2.3. Change of Major: From Another College or School to EVEN

Students transferring into EVEN from another of the University of Colorado at Boulder's Colleges and Schools (e.g., College of Arts and Sciences, School of Business) must first complete an Intra-University Transfer (IUT) application to the College of Engineering and Applied Sciences (details are available in the Dean's Office or at http://ecadw.colorado.edu/engineering/prospective/transfer_cu-boulder.htm). 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. Students changing majors to EVEN from non-engineering degrees must complete the mathematics, chemistry, and physics requirements of the first year of the College's Open Option curriculum to apply for IUT; therefore, they will typically start EVEN with credit for most of the first year of the EVEN curriculum.

4.2.4. Change of Major: From Another Campus of the University of Colorado System

Students transferring into EVEN from another campus of the University of Colorado system will, in almost all cases, have the same status as transfers from the University of Colorado at Boulder. Students from other CU campuses should refer to the three change-of-major sections above. More details on Intercampus Transfer to the College of Engineering and Applied Sciences are available in the Dean's Office or online (http://ecadw.colorado.edu/engineering/prospective/transfer_other_cu.htm).



EVEN 2001 graduate Durelle Scott (the headless rider) drives an ATV in a flooded road near a creek to simulate the generation of suspended sediment by off-highway vehicle recreation.

4.2.5. Transfer from Another Institution

Students transferring from another university or community college can find information on the College of Engineering and Applied Science website (http://ecadw.colorado.edu/engineering/prospective/transfer_students.htm). 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 Director for evaluation of transfer credits for the EVEN curriculum. Note that acceptance of transfer credits by the admissions office does not mean 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 most cases, identification of courses is straightforward; however, for some courses, the EVEN Director may request documentation of course content (catalog descriptions, course syllabi).

4.2.6. 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 by the College of Engineering and Applied Sciences as part of the admission process. AP and IB credits must also be evaluated for credit toward the EVEN curriculum by the student's faculty advisor or the EVEN Director. 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 (available in the dean's office or online at http://engineering.colorado.edu/students/advising.htm).

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.

4.2.7. Continuing Education Courses

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

- Maymester
- Summer Session
- Available Credit for Eligible Special Students (ACCESS)
- Center for Advanced Engineering and Technology Education (CAETE)
- Boulder Evening Credit
- Independent Learning
- Concurrent High School

A maximum of 16 credit hours taken through Continuing Education programs other than Maymester and Summer Session can be applied to the EVEN BS degree (Maymester and Summer Session courses are equivalent to courses offered during the regular academic year). A maximum of 8 of the 16 credit hours can be taken as Humanities and Social Sciences courses. According to the College of Engineering and Applied Science, students must secure advance approval of the Environmental Engineering Program and the Dean's Office prior to registering for Continuing Education courses. A credit registration form may be obtained at http://www.colorado.edu/ContEd/register.htm.

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 BS degree requires 18 credit hours of H&SS courses. One H&SS course is required – a communications course (see section 4.3.2) – to improve writing and oral presentation skills. For the remaining 15 credit hours of the H&SS requirements, 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. See below for some specific courses that may interest environmental engineering students.

Prof. 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 in Spring 2003.

4.3.2. Humanities and Social Sciences Requirements

The Environmental Engineering Program follows the College of Engineering and Applied Science H&SS requirements (http://ecadw.colorado.edu/engineering/Advising_Guides/HSS.pdf). A total of 18 credit hours of H&SS electives is required for graduation. At least nine of the required credit hours must be at the upper division level (3000- or 4000-level courses). A course on writing and oral presentations is required, which provides three credit hours of upper division H&SS credit. The remaining courses must be selected from the College's approved H&SS course lists (http://engineering.colorado.edu/homer/Fall2007.htm). **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.

Courses on the approved lists that might be of interest to environmental engineers include:

- ATLS 2000 The meaning of Technology
- ATLS 3519 Building Interactive Technology
- ATOC 4800 Policy Implications of Climate Controversy
- BAKR 1500 Colorado: History, Ecology, and Environment
- ECON 3535 Natural Resources Economics (prerequisite: ECON 1000 or 2010, restricted to nonmajors)
- ECON 3545 Environmental Economics (prerequisite: ECON 1000 or 2010, restricted to nonmajors)
- ENVS 4800 Critical Thinking in Environmental Studies
- CVEN 4700/5700 Sustainability in the Built Environment
- GEEN 1100 Social Impact of Technology

- GEEN 1510 Self Management and Leadership
- GEEN 3300 Sustainability Ethics and Practice
- GEOG 4430 Seminar: Conservation Trends (restricted to junior/senior GEOG/ENVS majors)
- GEOG 4742 Environments and Peoples (recommended prerequisites: GEOG 1982, 1992, 2002 or 2412; restricted to juniors/seniors)
- GEOG 4812 Environment and Development in South America (recommended prerequisites: GEOG 1982, 1992, 2002, 3812,3422, ANTH 3110 or PSCI 3032)
- GEOG 4822 Environment and Development in China (recommended prereqs: GEOG 1982, 1992, 2002 or HIST 1608)
- GEOL 4080 Societal Problems and Earth Sciences (prereq: 1 year calculus, 1 year natural science or equiv, or instructor consent)
- GEOL 4500 Critical Thinking in Earth Sciences (prerequisite: 1000-level science sequence)
- GRMN/HUMN 1701 Nature and Environment in German Literature and Thought
- HIST 4324 History of Modern Science (prerequisite: HIST 1020)
- INVS 1000 Responding to Social and Environmental Problems Through Service Learning
- PHIL 3140 Environmental Ethics (prerequisite: PHIL 1100, 1200, 2200, 3100 or 3200, or sophomore standing)
- PSCI 3064 Environmental Political Theory (
- SEWL 2000 America, the Environment, and the Global Economy

- HUEN or EHON courses, offered by the Herbst Program in the Humanities, and designed especially for engineers. A list of current offerings can be found at http://engineering.colorado.edu/herbst/courses.asp.

Students may petition the College of Engineering and Applied Sciences for approval of an H&SS course not on the previously approved lists. It is strongly suggested that the petition be approved before enrolling in the course. The college encourages meaningful groupings of courses in related subjects and thus may approve courses that are not on the list if they form a coherent plan of study. (Prior approval has already been granted for groups of four courses that would count toward a minor in certain fields, listed at http://engineering.colorado.edu/homer/Fall2007.htm.) Students may petition for approval of other meaningful groupings of courses. The following courses may be of interest to environmental engineers and **might be approved** for inclusion in such a grouping (**you must petition for approval!)**:

- ANTH 4150 Human Ecology (prerequisite: ANTH 2010 and 2020, or EBIO 1210 and 1220)
- ENVS 3003/ETHN 3011 Race, Class, and Pollution Politics (restricted to junior/senior ENVS or ETHN majors)
- ENVS 3020 Advanced Writing in Environmental Studies (restricted to junior/senior ENVS majors)
- ENVS 4100 Topics in Environmental Policy
- GEOG 2002 Geographies of Global Change
- GEOG 2412 Environment and Culture
- GEOG 3412 Conservation Practice and Resource Management (restricted to GEOG and ENVS majors)
- GEOG 3422 Conservation Thought
- HIST 4417 Environmental History of North America (prerequisite: HIST 1015, 1025, 1035 or 1045; restricted to sophomores/juniors/seniors)
- MCDB 1030 Plagues, People, and Microorganisms (for nonmajors)
- PHIL 2140 Environmental Justice
- PSCI 3201 Environment and Public Policy (prerequisite: PSCI 1101)
- SOCY 2077 Environment and Society
- additional courses from the required and recommended curricula for the Environmental Studies program in the College of Arts and Sciences (http://www.colorado.edu/envirostudies/)

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

- GEEN 3000 Professional Communications for Engineers
- PHYS 3050 Writing in Physics: Problem-Solving and Rhetoric (prereq: PHYS 2130 or 2170 and lower-division core writing requirement)
- HUEN 3100 Humanities for Engineers 1 (prerequisite: junior standing & program approval)
- 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)

Students who entered the college prior to fall 2007 may choose to follow the old policy, found at http://engineering.colorado.edu/homer/Prefall2006.htm. Students may not, however, choose a mixture of elements from both policies.

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

Some 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 as 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 ASTR, CHEM, EBIO, MATH, MCDB, PHYS.

EVEN 2004 graduates Richard Comstock, Ian Crocker, and Robbie Rebel in the CVEN 3454 Water Chemistry laboratory.

4.3.4. Advice on Humanities and Social Sciences Course Selection

Guidance in the H&SS course selection process is available through the College of Engineering and Applied Sciences (see the online guide HOMER, http://engineering.colorado.edu/homer/).

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 prescribed by the American Academy of Environmental Engineers (AAEE; http://www.aaee.net/) for environmental engineering curricula. Students should consult their faculty advisors to plan their technical elective program.

4.4.2. Technical Elective Requirements

The EVEN BS curriculum requires twelve 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 in social sciences (economics, psychology, human geography); and
- independent study courses with appropriate quantitative analysis.

One of the technical elective courses (3 credit hours) may be a 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; admission to 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 division or upper division level. See the list of recommended earth science courses in the Appendix.

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

A list of selected courses that will meet this requirement appears in the Appendix. If a course is not on this list, check with your advisor or the program coordinator; you may need to petition to have the course approved as a technical elective.

Independent study (see Section 4.6) is accepted as technical elective credit up to a maximum of 6 credit hours.

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

4.4.4. Advice on 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. See the Appendix for a specific list. Some courses (e.g., ATOC 1050, GEOL 1010) have associated optional labs that will satisfy the air or earth science lab or field requirement.

EVEN/CHEN 2004 graduate Lily Isenhart perches precariously for a precious water sample from the Snake River in Summit County.

Many students have found that a course devoted to the use of computer software for engineering drawing (e.g., AutoCAD®) or geographic information science (GIS) and mapping (e.g. ARCview®) can open up job opportunities. The following courses are available on the Boulder campus:

- AREN 1017 Engineering Drawing
- GEOG 3053 Cartography: Visualization and Information Design (restricted to junior/senior GEOG/ENVS majors)
- GEOG 3093 Geographic Interpretation of Aerial Photographs (restricted to junior/senior GEOG/ENVS majors)
- GEOG 4043 Cartography 2: Interactive and Multimedia Mapping (prerequisite: GEOG 3053)
- GEOG 4083 Mapping from Remotely Sensed Imagery (prerequisite: 3093, 4093 or equiv; restr to JR/SR GEOG/ENVS majors)
- GEOG 4093 Remote Sensing of the Environment
- GEOG 4103/4203/4303 Geographic Information Science (prerequisite: GEOG 2053 or 3053; restricted to junior/senior GEOG/ENVS majors)

Many students are interested in energy-related courses. Some of these courses can be found in the Appendix. It is also suggested that students check each semester for courses in individual departments' special topics classes for energy-related courses, as well as other topics of interest.

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.

4.5. 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, upper division technical electives must complete the remaining credits. The following courses will fulfill the lab/field requirement:

- ATOC 1070 Weather and the Atmosphere Lab (1) (prereq or co-req: ATOC 1050 or instructor consent)
- CVEN 3708 Geotechnical Engineering 1 (3) (prerequisite: CVEN 3161)
- EVEN 4100 Environmental Sampling and Analysis (3) (prerequisites: CVEN 3454 & 4424 or equivalent)
- GEOG 4411 Methods of Soil Analysis (3) (prerequisites: GEOG 1001 or 1011; prereq/co-req: GEOG 4401)
- GEOL 1030 Introduction to Geology Lab (1) (prior or current registration in 1000-level GEOL recommended)
- GEOL 2700 Introduction to Field Geology (2) (prerequisites: GEOL 1010 & 1020 or GEOL 1060 & 1070 or GEOG 1001 & 1011)
- GEOL 3010 Introduction to Mineralogy (3) (prerequisites: CHEM 1111/CHEN 1211, MATH 1300/APPM 1350)
- GEOL 4716 Environmental Field Geochemistry (2) (prerequisites: GEOL 2700 and chemistry sequence)

4.6. Independent Study

4.6.1. 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). 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.

4.6.2. 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 option 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 filling out the Independent Study Agreement Form and submitting the form to the EVEN Program Coordinator.
- The EVEN director must approve the proposed independent study.
- A final product of the independent study must be submitted to the Environmental Engineering Program before a grade will be sent to the registrar's office for posting.
- Approval of a second independent study is contingent on successful completion of the requirements for the first independent study. A copy of the Independent Study Agreement Form for the previous independent study must accompany the second application.
- Independent studies may not be arranged retroactively.
- Independent study credit is not allowed for internship experiences, work-study, or work done for pay, following University rules.

4.6.3. Independent Study Procedures

To propose an independent study, students must first determine with a collaborating faculty member the topic, goals, number of credit hours (up to 3 per semester), 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 to the EVEN Program Coordinator before the drop/add deadline of the semester in which the independent study will be conducted.

EVEN 2004 graduates Venessa Sanchez and Adam Musulin sample water at the Coors plant in Golden, Colorado.

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 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.

4.6.4. Senior Thesis

Students completing two independent studies for a total of six credit hours during the fall and spring semesters of their fourth year may write a senior thesis. A senior thesis shows 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. The completed thesis must be submitted to the Environmental Engineering Program coordinator by the final day of the semester during which the second independent study is completed.

4.7. Petitions

4.7.1. Petition Rules and Guidelines

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 will then be forwarded to the Dean's Office. It is the student's responsibility to follow up on the petition's progress. Petition forms may be obtained from the Program Coordinator, the dean's office, or from http://engineering.colorado.edu/students/advising.htm.

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
- 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
- to request approval of humanities and social sciences classes or groups of 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 Course 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 Program Coordinator and faculty advisor for clarification of Program rules and policies.
- write 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 syllabi.

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

4.7.2. One-Time Forgiveness Policy

The College of Engineering offers a one-time forgiveness policy to allow correction of a significant registration error resulting in an unanticipated grade. As indicated by the title, the forgiveness policy can be used only once. Forgiveness may be requested in a petition describing the registration error. Students on academic probation or suspension may not use this policy. See also http://www.colorado.edu/policies/courserepetition.html for information on the Boulder campus Course Repetition Policy.

4.8. 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 of your own or of others to a fellow student

The College of Engineering and Applied Science procedures for handling academic ethics violations are available in the Dean's Office and on the College of Engineering and Applied Science web site (http://engineering.colorado.edu/students/honor_code.htm). University academic honesty policies are available at the Honor Code web site (http://www.colorado.edu/academics/honorcode/).

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 (see Section 2.1). Students must satisfactorily complete 128 credit hours, of which the last 45 credit hours shall be earned after admission to the College of Engineering and Applied Science as a degree student.
2. A minimum cumulative grade point average of 2.000 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 2.000. This major grade point average includes only course work in engineering courses.
4. Successful completion of the Minimum Academic Preparation Standards (MAPS) requirement of the College of Engineering and Applied Science.
5. Completion of the Fundamentals of Engineering (FE) examination during the final academic year.
6. Notification to the EVEN program coordinator of intent to graduate.
7. Submission of a completed Diploma Card (available in the EVEN or dean's office) to the dean's office.

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.

To be sure that all requirements are met, students can consult with the Environmental Engineering Program Coordinator, Director, and their faculty advisors. 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 (http://ecadw.colorado.edu/engineering/Advising_Guides/grading.pdf). Student performance is determined by course instructors. Instructors award grades following the University of Colorado standardized grading system (Table 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.

Table 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	
IF		incomplete
NC		no credit
P		pass in a pass/fail course

Other grades appearing on student transcripts include Incomplete (IF), No Credit (NC), and Pass (P). A grade of IF indicates that course requirements were not completed owing to documented reasons beyond the control of the student. Grades of IF require completion of an "IF Grade Record" 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 IF 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. 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.

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 with the opportunity to complete the first step toward 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. You must be within 32 credits of graduation to be allowed to take the FE exam.

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; http://www.ncees.org). The FE Exam is offered semiannually, in April and October. Registration notices will be distributed by the EVEN Program Coordinator, and students must coordinate their registrations with the EVEN office.

The exam consists of two parts, the morning and afternoon "specifications." The morning specification covers engineering, science, and mathematics fundamentals. The afternoon specification is discipline-specific. Environmental Engineering is offered as an afternoon specification. Students may also take one of the other specifications, such as Chemical Engineering or General Engineering. The NCEES offers general information, study materials, and sample questions for the FE Exam, and a copy of the current *FE Reference Handbook* can be downloaded from the NCEES website. Numerous review books for the FE Exam are also readily available at web booksellers. Check with the program coordinator about possible review sessions held by engineering departments.

5.3. Requirements for Dual Degrees

Students may choose to pursue a second Bachelor of Science degree simultaneously with the EVEN BS degree. The second BS degree may be pursued in a College or School at the University of Colorado at Boulder. To do this, they must (1) satisfy the requirements of both BS degree curriculum and (2) take a minimum of 30 credit hours beyond the credit hour requirement for the degree with the higher credit hour requirement. If the requirements of both curricula can be satisfied with fewer than 30 credit hours, the difference can be made up with elective courses. 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 http://www.colorado.edu/engineering/EnvEng/SEVEN.htm 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 mambers 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, Associate Professor, Civil, Environmental and Architectural Engineering, Water Resources.
Education: B.Tech, Regional Eng. College Kurukshetra, India (1989), M.Tech Indian Statistical Institute Calcutta, India (1991), Ph.D. Utah State University (1995)
Teaching: CVEN 4333/5333 Engineering Hydrology
Research: Stochastic Hydrology and Hydroclimatology, Nonparametric functional estimation techniques
Email: Rajagopalan.Balaji@Colorado.EDU, phone: 303 492-5968, office: ECOT 541

Angela Bielefeldt, Associate Professor, Civil, Environmental, and Architectural Engineering; EVEN Director
Education: B.S., Iowa State University (1992), M.S., Ph.D., University of Washington (1994, 1996)
Teaching: CVEN 4434 Environmental Engineering Design, CVEN 4474 Hazardous Waste Management
Research: Biological Treatment of Hazardous Organic Compounds, Subsurface Bioremediation
Email: angela.bielefeldt@colorado.edu, phone: 303 492 8433, office: ECOT 516

Melvyn Branch, Professor *Emeritus*, Mechanical Engineering
Education: B.S.E., Princeton U. (1966), M.S., Ph.D., University of California at Berkeley (1968, 1971)
Teaching: MCEN 4152 Introduction to Combustion, MCEN 4162 Energy Conversion
Research: Combustion-Generated Air Pollution, Hazardous Waste Destruction, Combustion Chemistry
Email: melvyn.branch@colorado.edu, phone: 303 492 3578; office: ECME 210

David Clough, Professor, Chemical and Biological Engineering
Education: B.S., Case Institute of Technology (1968), M.S., Ph.D., University of Colorado at Boulder (1969, 1975)
Teaching: GEEN 1300 Introduction to Engineering Computing, CHEN 3010 Applied Data Analysis
Research: Improved Control of Industrial Processes, Optimization and Control of Natural Resources Distribution
Email: david.clough@colorado.edu, phone: 303 492 6638, office: ECCH 126

John Crimaldi, Associate Professor, Civil, Environmental, and Architectural Engineering
Education: B.S.E. Princeton University (1987), Ph.D. Stanford University (1998)
Teaching: CVEN 3313 Theoretical Fluid Mechanics, CVEN 5313 Environmental Fluid Mechanics, CVEN 5343 Transport and Dispersion in Surface Water, CVEN 6833 Advanced Environmental Fluid Mechanics
Research: Interaction of fluid mechanics with biological or ecological systems, Scalar transport; structure of passive chemical plumes, Turbulent processes in benthic boundary layers
Email: john.crimaldi@colorado.edu, phone: 303 735 2162, office: ECOT 511

John Daily, Professor, Mechanical Engineering
Education: B.S., M.S., U. Michigan (1969, 1970), Ph.D., Mechanical Engineering, Stanford University (1975)
Research: Hazardous Waste Destruction, Combustion, Propulsion
Email: john.daily@colorado.edu, phone: 303 492 7110, office: ECME 224

William Emery, Professor, Aerospace Engineering Science
Education: B.S., Brigham Young U. (1971), Ph.D., U. Hawaii (1975)
Teaching: EVEN 4830 Environmental Satellite Remote Sensing
Research: Satellite Remote Sensing of Oceans, Vegetation and Urban Studies
Email: william.emery@colorado.edu, phone: 303 492 8591, office: ECME 220

Michael Hannigan, Assistant 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
Research: Characterization and Abatement of Air Pollution
Email: michael.hannigan@colorado.edu, phone: 303 735 5045, office: ECME 218

Mark Hernandez, Associate Professor, Civil, Environmental, and Architectural Engineering
Education: B.S., M.S., Ph.D., University of California at Berkeley (1986, 1988, 1994)
Teaching: CVEN 3414 Fundamentals of Environmental Engineering, CVEN 4484 Introduction to Environmental Microbiology, AREN 2110 Thermodynamics
Research: Biological Waste Treatment Processes, Microbiology of Aerosols, Microbially induced corrosion
Email: mark.hernandez@colorado.edu, phone: 303 492 5991, office: ECOT 515

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 4030 Computational Methods
Research: Combustion Fluid Mechanics, Hazardous Waste Destruction
Email: jean.hertzberg@colororado.edu, phone: 303 492 5092; office: ECME 220

Karl Linden, Professor, Liebman Faculty Fellow, Civil, Environmental, and Architectural Engineering
Education: BS, Science, Agricultural and Biological Engineering, Cornell University, (1989), MS, Civil and Environmental Engineering, University of California (1993), Ph.D., Civil and Environmental Engineering, University of California (1997)

Teaching: CVEN 5834 Special Topics: UV treatment; CVEN 3414 Fundamentals of Environmental Engineering
Research: Water Treatment, Wastewater Treatment, Disinfection, Advanced Oxidation
Email: karl.linden@colorado.edu, phone: 303 492 4798, office: ECOT 542

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
Research: Aquatic Ecology, Aquatic Chemistry
Email: diane.mcknight@colorado.edu, phone: 303 492 4687 or 492 7573, office: ECOT 543 or RL-1, 118

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
Research: Air Quality Modeling, Atmospheric Chemistry
Email: jana.milford@colorado.edu, phone: 303 492 5542, office: ECME 214

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
Research: Indoor Air Quality, Bioaerosols
Email: shelly.miller@colorado.edu, phone: 303 492 0587; office: ECME 222

Roseanna Neupauer, Assistant Professor, Civil, Environmental and Architectural Engineering
Education: B.S., Carnegie Mellon University (1989); S.M., Massachusetts Institute of Technology (1991); M.S., Ph.D, New Mexico Tech (1999, 2000)
Teaching: CVEN 4353/5353 Groundwater Engineering; CVEN 3323 Hydraulics
Research: groundwater flow and transport modeling, porous media heterogeneity, contaminant source characterization
Email: Roseanna.Neupauer@colorado.edu; phone: 303 492 6274; office: ECOT 513

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)
Teaching: Fluid Mechanics, Membranes, Energy, Separations, Engineering Economics
Research: Water, Energy, Membranes
Email: john.pellegrino@colorado.edu, phone: 303 735 2631, office:

Hari Rajaram, Professor, Civil, Environmental, and Architectural Engineering
Education: B.Tech., IIT, Madras (1985), M.S., U. Iowa (1987), Sc.D., M.I.T. (1991)
Teaching: CVEN 4353 Groundwater Engineering; CVEN 3313 Fluid Mechanics
Research: Groundwater and Contaminant Hydrology, Stochastic Modeling of Transport Processes
Email: hari.rajaram@colorado.edu, phone: 303 492 6604, office: ECOT 514

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: CVEN 3414 Fundamentals of Environmental Engineering, CVEN 3454 Water Chemistry, CVEN 4424 Environmental Organic Chemistry
Research: Contaminant Fate and Transport in Natural Waters, Surface and Colloid Chemistry
Email: joseph.ryan@colorado.edu, phone: 303 492 0772, office: ECOT 517

JoAnn Silverstein, Professor and Chair, 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
Research: Biological Treatment of Contaminants in Water and Wastes, Water Reuse
Email: joann.silverstein@colorado.edu, phone: 303 492 7211, office: ECOT 444

Scott Summers, Professor, Civil, Environmental, and Architectural Engineering
Education: B.S., M.S., University of Cincinnati (1980, 1982), Ph.D., Stanford University (1986)
Teaching: CVEN 3424 Water and Wastewater Treatment
Research: Drinking Water Quality and Treatment, Disinfection By-Products, Natural Organic Matter
Email: r.summers@colorado.edu, phone: 303 492 6644, office: ECOT 540

Forms and Appendices

The forms listed below are available on the following pages:

- Special Option Selection Proposal
- Advising Evaluation Form
- Independent Study Agreement Form
- Degree Requirements Worksheet
- Technical Elective Suggestions
- Table of Prerequisites and co-requisite courses for required courses in the EVEN BS curriculum
- Useful Websites

Environmental Engineering Program

College of Engineering and Applied Science

University of Colorado at Boulder

Special Option Selection Proposal

Student Name: _____ Student number: _____

Class standing (circle): First-year Second-year Third-year Fourth-year Fifth-year

Degree Program (circle): EVEN BS EVEN BS/CVEN MS

Faculty Advisor Name: _____

Title for Area of Specialization for Special Option:

Proposed Courses for Special Option (total of 9 credit hours):

Course Number and Name	Credits
1.	
2.	
3.	
4.	
5.	

Explanation of Need for Special Courses (i.e., difference from regular Options; importance for an Environmental Engineering education):

_____ _____

Student Signature Date Faculty Advisor Signature Date

Received by Program Coordinator _____
Date

Director Approval: Approved Returned for Amendment Disapproved

Comments:

_____
Director Signature Date

Advising Evaluation

EVEN Students: We are conducting this survey to get your opinions about EVEN academic advising. We will use your opinions to improve academic advising in the Environmental Engineering Program. We need your participation in this process; therefore, you must return this survey to get your registration flag lifted. Return the completed survey to the Program Coordinator (ECOT 518).

Advisor's Name: _____ Date: _____

How was your advising experience? (Rate from 1 to 5 with 1 being poor and 5 being excellent.)

1	2	3	4	5
Poor				Excellent

Please explain your numeric evaluation:

How could we improve the advising process?

Did you have any problem scheduling courses that you need to graduate? If so, which courses?

Is your advisor knowledgeable about your career interests or option track in Environmental Engineering? If not, have you sought out other EVEN faculty for advice?

Please circle or highlight your status and degree program:

First-year Second-year Third-year Fourth-year Fifth-year

EVEN BS EVEN BS/CVEN MS

Please circle or highlight your option track (third-year students and fourth-year students):

Air Quality Applied Ecology Chemical Proc Energy Env Remed Water Res/Trtmt Special

Environmental Engineering Program
College of Engineering and Applied Science
University of Colorado at Boulder

Independent Study Proposal

Student Name: _____ Student number: _____

Class standing: First-year Second-year Third-year Fourth-year Fifth-year

Degree Program: EVEN BS EVEN BS/CVEN MS

Option: Air Qual Appl Ecol Chem Proc Energy Env Remed Water Res/Trtmt Special

Previous number of Independent Study hours earned for EVEN degree: _____

Previous number of Independent Study hours earned outside this major: _____

Collaborating Faculty Name: _____

Semester: _____ Credit hours (1-3): _____

Independent Study Title: _____

Work to be done:

Products required for successful completion:

_____ _____

Student Signature Date Collaborating Faculty Signature Date

Received by Program Coordinator _____
Date

Director Approval: Approved Returned for Amendment Disapproved

Comments:

Director Signature _____ Date _____

Registered by Program Coordinator _____ Course Number: _____ Date

Degree Requirements Worksheet – EVEN BS Degree 2008-2009

Student Name: _____ Student#:_____

Faculty Advisor: _____ Catalog year:_____ Major year:_____

Required Courses

course no.	course name	credits	course taken (if different)	grade	term
Engineering (53 hours)					
EVEN 1000	Intro to Environmental Engineering	1			
GEEN 1300	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			
CVEN 3454	Water Chemistry	4			
[2]	Engineering Economics	3			
[3]	Fluid Mechanics	3			
[4]	Thermodynamics	3			
CVEN 4424	Environmental Organic Chemistry	3			
[5]	Heat Transfer	3			
CVEN 4484	Intro to Environmental Microbiology	3			
MCEN 4131	Air Pollution Control	3			
[6]	Probability and Statistics	3			
CVEN 4333	Engineering Hydrology	3			
CVEN 4444	Environmental Engineering Processes	3			
CVEN 4434	Environmental Engineering Design	3			
			Engineering Total (**53**)		
Mathematics (16 hours)					
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			
			Mathematics Total (**16**)		
Sciences (17 hours)					
CHEN 1211	General Chemistry	3			
CHEM 1221	General Chemistry Laboratory	2			
PHYS 1110	General Physics 1	4			
PHYS 1120	General Physics 2	4			
PHYS 1140	Experimental Physics 1	1			
CHEM 4521	Physical Chemistry for Engineers	3			
			Sciences Total (**17**)		

[1] Solid Mechanics options: CVEN 2121 Analytical Mechanics, GEEN 3851 Statics for Engrs, MCEN 2023 Statics and Structures.

[2] Engineering Economics options: EMEN 4100 Business Methods & Economics for Engineers, CVEN 4147 Engineering Economy & System Design, EVEN 4830 Technoeconomic Analysis for Environmental Engineering

[3] Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics, CVEN 3313 Fluid Mechanics, GEEN 3853 Fluid Mechanics for Engineers, MCEN 3021 Fluid Mechanics.

[4] Thermodynamics options: AREN 2110 Thermodynamics, CHEN 3320 Chemical Engineering Thermodynamics, GEEN 3852 Thermodynamics for Engineers, MCEN 3012 Thermodynamics.

[5] Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer, MCEN 3022 Heat Transfer.

[6] Probability & Statistics options: APPM 4570 Statistical Methods, CHEN 3010 Applied Data Analysis, CVEN 3227 Probability, Statistics, & Decisions.

course no.	course name	credits	course taken	grade	term
Humanities & Social Sciences Electives (18 hours, 9 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 Communication Course				
			H&SS Total (**18**)		
Option Courses (9 hours)					
[8]	Option 1				
	Option 2				
	Option 3				
			Option Total (**9**)		
Technical Electives (12 hours, 9 hours upper division, 3 Earth Science)					
[9]	Tech (lower or upper division)				
	Tech (upper division)				
	Tech (upper division)				
	Tech (upper division)				
			Technical Elective Total (**12**)		
[10]	Air/Earth Lab/Field Course				
			Air/Earth Lab/Field Course **(3)**		

Credit hour Total: ____ **(128)** **Grade Point Average:** ____

MAPS Complete: ____ **Date:** ____

FE Exam: ____ **Date:** ____

Preliminary Check: ____ **Date:** ____

Final Check: ____ **Date:** ____

[7] Communications course: WRTG 3030 Writing on Science and Society, HUEN 3100 Humanities for Engineers, WRTG 3035 Technical Communication and Design, GEEN 3000 Professional Communications for Engineers, PHYS 3050 Writing in Physics.

[8] Consult Environmental Engineering (EVEN) Degree Guidelines for lists of Option courses.

[9] 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 (EVEN 4840) may be completed as technical electives for up to 6 credits total, 3 credits per semester.

[1010] 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 a technical elective. Options: ATOC 1070 Weather and the Atmosphere Lab (1), CVEN 3708 Geotechnical Engineering, EVEN 4100 Environmental Sampling, GEOG 4411 Methods of Soil Analysis, GEOL 1030 Intro to Geology Lab, GEOL 2700 Intro to Field Geology (2), GEOL 3010 Intro to Mineralogy, GEOL 4716 Environmental Field Geochemistry (2)

Technical Elective Suggestions

Any of the courses listed in the options (p. 9) are good technical electives. Other example Technical Elective Courses for EVEN are listed below. If a course is not on this list, you may request approval on a petition form.

Check for prerequisites in the catalog: http://www.colorado.edu/catalog/catalog08-09.

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.

Arts & Sciences

APPM 3010 (3) An Introduction to Nonlinear Systems: Chaos
APPM 3050 (3) Scientific Computing in Matlab
APPM 3170 (3) Discrete Applied Mathematics
APPM 3310 (3) Matrix Methods and Applications
APPM 3570 (3) Applied Probability
APPM 4120 (3) Introduction to Operations Research
APPM 4350 (3) Methods in Applied Mathematics: Fourier Series and Boundary Value Problems
APPM 4360 (3) Methods in Applied Mathematics: Complex Variables and Applications
APPM 4380 (3) Modeling in Applied Mathematics
APPM 4540 (3) Introduction to Time Series
APPM 4560 (3) Markov Processes, Queues, Monte Carlo Sims
APPM 4580 (3) Statistical Applications: Software & Mth
APPM 4650 (3) Intermediate Numerical Analysis 1
APPM 4660 (3) Intermediate Numerical Analysis 2
APPM 4720 (3) Open Topics in Applied Mathematics

ATOC 1050 (3) Weather and the Atmosphere *
ATOC 1060 (3) Our Changing Environment: El Nino, Ozone and Climate *
ATOC 1070 (1) Weather and the Atmosphere Lab * †
ATOC 3180 (3) Aviation Meteorology *
ATOC 3300 (3) Analysis of Climate and Weather Observation *
ATOC 3500 (3) Air Chemistry and Pollution
ATOC 3600 (3) Principles of Climate *
ATOC 3720 (3) Planets and Their Atmospheres
ATOC 4215 (3) Oceanography
ATOC 4720 (3) Intro to Atmospheric Physics & Dynamics *
ATOC 4750 (3) Desert Meteorology and Climate *

CHEM 3311 (4) Organic Chemistry 1
CHEM 3321 (1) Lab in Organic Chemistry 1
CHEM 3331 (4) Organic Chemistry 2
CHEM 3341 (1) Lab in Organic Chemistry 2
CHEM 4011 (3) Modern Inorganic Chemistry
CHEM 4021 (3) Inorganic Laboratory
CHEM 4171 (3) Instrumental Analysis
CHEM 4181 (4) Instrumental Analysis Lab with Environ Emphasis
CHEM 4431 (3) Physical Chemistry w Biochemistry Applications 2
CHEM 4531 (3) Physical Chemistry 2
CHEM 4541 (2) Physical Chemistry Laboratory for Engineers
CHEM 4581 (1) Physical Chemistry Lab 1
CHEM 4591 (2) Physical Chemistry Lab 2
CHEM 4611 (3) Survey of Biochemistry
CHEM 4621 (3) Genome Databases: Mining and Management
CHEM 4711 (3) General Biochemistry 1
CHEM 4731 (3) General Biochemistry 2
CHEM 4751 (3) Current Topics in Biochemical Research
CHEM 4761 (4) Biochemistry Laboratory
CHEM 4791 (3) Bioorganic Chemistry in Biotechnology

EBIO 1210 (3) General Biology 1
EBIO 1220 (3) General Biology 2
EBIO 1230 (1) General Biology Laboratory 1
EBIO 1240 (1) General Biology Laboratory 2
EBIO 2010 (1-3) Environmental Issues and Biology
EBIO 2040 (4) Principles of Ecology
EBIO 2070 (4) Genetics: Molecules to Populations
EBIO 2500 (4) Introduction to Horticulture
EBIO 2590 (2) Plants and Society
EBIO 2670 (5) Honors Genetics Molecules to Population
EBIO 3040 (4) Conservation Biology
EBIO 3080 (4) Evolutionary Biology
EBIO 3110 (3) Population and Community Ecology
EBIO 3170 (3-4) Arctic and Alpine Ecology
EBIO 3175 (1) Arctic and Alpine Ecology Lab
EBIO 3180 (3) Global Ecology
EBIO 3190 (3) Tropical Marine Ecology
EBIO 3240 (4) Animal Behavior
EBIO 3270 (3) Ecosystem Ecology
EBIO 3520 (4) Plant Systematics
EBIO 3530 (4) Functional Plant Biology
EBIO 3630 (4) Parasitology
EBIO 3770 (4) Animal Diversity: Vertebrates
EBIO 3850 (4) Animal Diversity: Invertibrates
EBIO 4020 (3) Stream Biology
EBIO 4030 (3) Limnology
EBIO 4060 (3) Landscape Ecology
EBIO 4100 (3) Advanced Ecology
EBIO 4110 (3) Advanced Ecology
EBIO 4120 (2-4) Advanced Ecology
EBIO 4140 (3) Plant Ecology
EBIO 4150 (1-2) Techniques in Ecology
EBIO 4160 (3) Introduction to Biogeochemistry
EBIO 4175 (3) Scientific Basis for Ecosystem Managemt Public Lands
EBIO 4180 (3) Ecological Perspectives on Global Change
EBIO 4290 (3) Molecular Systematics and Evolution
EBIO 4410 (4) Biometry
EBIO 4660 (4) Insect Biology
EBIO 4740 (3) Biology of Amphibians and Reptiles
EBIO 4750 (4) Ornithology
EBIO 4760 (4) Mammalogy

ENVS/PHYS 3070 (3) Energy and the Environment

GEOG 1001 (4) Environ'l Systems 1- Climate & Vegetation *
GEOG 1011 (4) Environ'l Systems 2 - Landscapes and Water *

GEOG 3053 (3) Catography: Visualization and Information Design
GEOG 3093 (3) Geographic Interpretation of Aerial Photographs
GEOG 3251 (3) Mountain Geography *
GEOG 3301 (3) Analysis of Climate and Weather Observation *
GEOG 3351 (3) Biogeography
GEOG 3601 (3) Principles of Climate *
GEOG 4043 (3) Cartography 2: Interactive & Multimedia Mapping
GEOG 4083 (4) Mapping from Remotely Sensed Imagery
GEOG 4093 (4) Remote Sensing of the Environment
GEOG 4103 (4) Introduction to Geographic Information Science
GEOG 4201 (3) Biometeorology *
GEOG 4203 (4) Geographic Information Science: Modeling Applic
GEOG 4211 (3) Physical Climatology - Principles *
GEOG 4231 (4) Physical Climatology/Field Methods *
GEOG 4241 (4) Principles of Geomorphology *
GEOG 4251 (4) Fluvial Geomorphology *
GEOG 4291 (3-4) Mountain Geomorphology *
GEOG 4303 (4) Geographic Information Science: Programming
GEOG 4311 (3) Watershed Biogeochemistry
GEOG 4321 (3-4) Snow Hydrology
GEOG 4331 (3-4) Mountain Climatology *
GEOG 4371 (3) Forest Geography: Principles and Dynamics
GEOG 4401 (3) Soils Geography *
GEOG 4411 (3) Methods of Soil Analysis * †
GEOG 4501 (3) Water Resources and Water Management of Western United States

GEOL 1010 (3) Introduction to Geology 1 *
GEOL 1020 (3) Introduction to Geology 2 *
GEOL 1030 (1) Introduction to Geology Laboratory 1 *
GEOL 1040 (3) Geology of Colorado *
GEOL 1060 (3) Global Change An Earth Science Perspective *
GEOL 2100 (3) Environmental Geology *
GEOL 2110 (4) Physical Science of the Earth System *
GEOL 2700 (2) Introduction to Field Geology * †
GEOL 3010 (3) Introduction to Mineralogy * †
GEOL 3020 (3) Petrology*
GEOL 3030 (3) Introduction to Hydrogeology *
GEOL 3040 (3) Global Change: The Recent Geological Record *
GEOL 3050 (2) Computer Assisted Geologic Techniques *
GEOL 3070 (3) Introduction to Oceanography
GEOL 3120 (4) Structural Geology *
GEOL 3300 (3) Extraterrestrial Life
GEOL 3320 (3) Introduction to Geochemistry *
GEOL 3410 (3) Paleobiology *
GEOL 3430 (4) Sedimentology and Stratigraphy *
GEOL 3500 (3) Earth Resources and the Environment *
GEOL 3520 (3) Environmental Issues in Geosciences *
GEOL 3540 (3) Introduction to Hydrocarbon Geology *
GEOL 3720 (3) Evolution of Life: The Geological Record *
GEOL 3950 (3) Natural Catastrophes & Geologic Hazards *
GEOL 4060 (4) Oceanography
GEOL 4093 (4) Remote Sensing of the Environment *
GEOL 4130 (3) Principals of Geophysics *
GEOL 4160 (3) Introduction to Biogeochemistry *
GEOL 4200 (3) Advanced Mineralogy *
GEOL 4241 (4) Principles of Geomorphology *
GEOL 4270 (3) Marine Chemistry and Geochemistry
GEOL 4291 (3-4) Mountain Geomorphology *
GEOL 4360 (3) Glacial Geology *
GEOL 4550 (3) Petroleum Reservoir Characterization & Modeling
GEOL 4640 (3) Glaciology *
GEOL 4670 (3) Isotope Geology *
GEOL 4711 (2) Igneous and Metamorphic Field Geology *
GEOL 4712 (2) Structural Field Geology *
GEOL 4714 (2) Field Geophysics *
GEOL 4715 (2) Field Tech in Surficial Geol & Geohydrol *
GEOL 4716 (2) Environmental Field Geochemistry * †
GEOL 4717 (2) Field Seminar in Geology and Tectonics *

IPHY 3060 (4) Cell Physiology
IPHY 3130 (3) Environmental Animal Physiology
IPHY 3410 (3) Introduction to Human Anatomy
IPHY 3415 (2) Human Anatomy Laboratory
IPHY 3420 (3) Nutrition, Health. and Performance
IPHY 3430 (3) Introduction to Human Physiology
IPHY 3435 (2) Human Physiology Laboratory
IPHY 3450 (5) Comparative Animal Physiology
IPHY 3460 (5) Comparative Vertebrate Anatomy
IPHY 3470 (3) Human Physiology 1
IPHY 3480 (3) Human Physiology 2
IPHY 3500 (2) Applied Clinical Research
IPHY 3660 (3) Dynamics of Motor Learning
IPHY 3730 (3) Brain and Behavior
IPHY 3800 (3) Forensic Biology
IPHY 3810 (1) Forensic Biology Laboratory
IPHY 4200 (3) Physiological Genetics and Genomics
IPHY 4440 (3) Endocrinology
IPHY 4470 (3) Biology of Human Reproduction
IPHY 4480 (3) Comparative Reproduction
IPHY 4500 (4) Histology: Cells and Tissues
IPHY 4540 (5) Biomechanics
IPHY 4600 (4) Immunology
IPHY 4650 (5) Exercise Physiology
IPHY 4720 (4) Neurophysiology
IPHY 4730 (3) Motor Control
IPHY 4740 (3) Theory of Motor Skills Learning
IPHY 4770 (3-4) Mind-Body Health

MATH 3170 (3) Combinatorics 1
MATH 3210 (3) Euclidean and Non-Euclidean Geometries
MATH 4000 (3) Foundations of Mathematics
MATH 4120 (3) Introduction to Operations Research
MATH 4140 (3) Abstract Algebra 2
MATH 4230 (3) Geometry of Curves and Surfaces
MATH 4310 (3) Introduction to Analysis
MATH 4320 (3) Multivariable Analysis
MATH 4330 (3) Fourier Analysis
MATH 4440 (3) Mathematics of Coding and Cryptography
MATH 4450 (3) Introduction to Complex Variables
MATH 4470 (3) Partial Differential Equations 1
MATH 4510 (3) Introduction to Probability Theory
MATH 4520 (3) Introduction to Mathematical Statistics
MATH 4540 (3) Introduction to Time Series
MATH 4650 (3) Intermediate Numerical Analysis 1
MATH 4660 (3) Intermediate Numerical Analysis 2

PHYS 2130 (3) General Physics 3
PHYS 2210 (3) Classical Mechanics and Math Methods 1
PHYS/ENVS 3070 (3) Energy and the Environment
PHYS 3210 (3) Classical Mechanics and Mathematical Methods 2
PHYS 3220 (3) Quantum Mechanics and Atomic Physics 1
PHYS 3310 (3) Principles of Electricity and Magnetism 1
PHYS 3320 (3) Principles of Electricity and Magnetism 2
PHYS 3330 (2) Electronics for the Physical Sciences
PHYS 3340 (3) Introductory Research in Optical Physics
PHYS 4110 (3) Analytical Techniques for Materials Analysis

PHYS 4130 (2) Biological Electron Microscopy
PHYS 4150 (3) Plasma Physics
PHYS 4230 (3) Thermodynamics and Statistical Mechanics
PHYS 4340 (3) Introduction to Solid State Physics
PHYS 4410 (3) Quantum Mechanics and Atomic Physics 2
PHYS 4510 (3) Optics

College of Engineering and Applied Science

ASEN 2500 (3) Gateway to Space
ASEN 3116 (3) Introduction to Biomedical Engineering
ASEN 4012 (3) Aerospace Materials
ASEN 4013 (3) Foundations of Propulsion
ASEN 4090 (3) Global Positioning Systems Applications
ASEN 4114 (3) Automatic Control Systems
ASEN 4148 (3) Spacecraft Design
ASEN 4215 (3) Oceanography
ASEN 4216 (3) Neural Signals & Functional Brain Imaging
ASEN 4218 (3) Large Space Structures Design
ASEN 4238 (3) Computer Aided Control System Design
ASEN 4248 (3) Computer Aided Control System Design 2
ASEN 4337 (3) Remote Sensing Data Analysis
ASEN 4338 (3) Computer Analysis of Structures
ASEN 4426 (3) Neural Systems and Physiological Control
ASEN 4436 (3) Brains, Minds, Computers

AREN 1017 (2) Engineering Drawing
AREN 1027 (2) Descriptive Geometry
AREN 2050 (3) Engineering Systems for Buildings
AREN 3010 (3) Mechanical Systems for Buildings
AREN 3050 (3) Environmental Systems for Buildings 1
AREN 3060 (3) Environmental Systems for Buildings 2
AREN 3130 (3) Building Energy Laboratory
AREN 3140 (3) Illumination Laboratory
AREN 3406 (3) Introduction to Building Construction
AREN 3540 (3) Illumination 1
AREN 4110 (3) HVAC Design 1
AREN 4315 (2) Design of Masonry Structures
AREN 4416 (3) Construction Costs and Estimating
AREN 4420 (3) Cost Engineering
AREN 4466 (3) Construction Planning and Scheduling
AREN 4540 (3) Exterior Lighting Systems
AREN 4550 (3) Illumination 2
AREN 4560 (3) Luminous Radiative Transfer
AREN 4570 (3) Building Electrical Systems Design 1
AREN 4580 (3) Daylighting
AREN 4590 (3) Computer Graphics in Lighting Engineering

CHEN 2810 (3) Biology for Engineers
CHEN 2820 (3) Foundations of Bioengineering
CHEN 3130 (2) Chemical Engineering Lab 1
CHEN 3220 (3) Separations and Mass Transfer
CHEN 4130 (2) Chemical Engineering Lab 2
CHEN 4330 (3) Reaction Kinetics
CHEN 4440 (3) Chemical Engineering Materials
CHEN 4450 (3) Polymer Chemistry
CHEN 4460 (3) Polymer Engineering
CHEN 4520 (3) Chemical Process Synthesis.
CHEN 4570 (4) Instrumentation and Process Control
CHEN 4580 (3) Numerical Methods for Proc Simulation
CHEN 4650 (3) Particle Technology
CHEN 4670 (3) Environmental Separations
CHEN 4680 (3) Environmental Process Engineering
CHEN 4800 (3) Bioprocess Engineering
CHEN 4805 (3) Biomaterials
CHEN 4820 (3) Biochemical Separations
CHEN 4838 (3) Sp Top: Energy Fundamentals

CVEN 2012 (3) Introduction to Geomatics
CVEN 3111 (3) Analytical Mechanics 2
CVEN 3161 (3) Mechanics of Materials 1
CVEN 3246 (3) Introduction to Construction
CVEN 3256 (3) Construction Equipment and Methods
CVEN 3323 (3) Hydraulic Engineering
CVEN 3424 (3) Water and Wastewater Treatment
CVEN 3434 (3) Introduction to Applied Ecology
CVEN 3525 (3) Structural Analysis
CVEN 3602 (3) Transportation Systems
CVEN 3698 (3) Engineering Geology *
CVEN 3708 (3) Geotechnical Engineering 1 * †
CVEN 3718 (3) Geotechnical Engineering 2 *
CVEN 4087 (3) Engineering Contacts
CVEN 4161 (3) Mechanics of Materials 2
CVEN 4266 (3) Project Administration
CVEN 4323 (3) Water Resource Engineering Design
CVEN 4343 (3) Open Channel Hydraulics
CVEN 4353 (3) Groundwater Engineering
CVEN 4474 (3) Hazardous and Industrial Waste Mgmt
CVEN 4511 (3) Intro Finite Elements
CVEN 4525 (3) Analysis of Framed Structures
CVEN 4537 (3) Numerical Methods in Civil Engineering
CVEN 4545 (3) Steel Design
CVEN 4555 (3) Reinforced Concrete Design
CVEN 4565 (2) Timber Design
CVEN 4718 (3) Mechanics and Dynamics of Glaciers
CVEN 4728 (3) Foundation Engineering
CVEN 4822 (3) Geographical Information Systems for Civil and Environmental Systems
CVEN 4838 (3) Sp Top:Sustainable Community Development 1
CVEN 5020 (3) Building Energy Audits
CVEN 5393 (3) Water Resources Development & Management

CSCI 2270 (4) Computer Science 2: Data Structures
CSCI 3202 (3) Introduction to Artificial Intelligence
CSCI 3287 (3) Database and Information Systems
CSCI 3308 (3) Software Engineering Methods and Tools
CSCI 3656 (3) Principles of Programming Languages
CSCI 3702 (3) Cognitive Science
CSCI 3753 (4) Operating Systems
CSCI 4113 (3) UNIX System Administration
CSCI 4202 (3) Artificial Intelligence 2
CSCI 4273 (3) Network Systems
CSCI 4446 (3) Chaotic Dynamics
CSCI 4448 (3) Object Oriented Analysis and Design
CSCI 4473 (3) Network Security
CSCI 4576 (4) High Performance Scientific Computing 1
CSCI 4586 (4) High Performance Scientific Computing 2
CSCI 4593 (3) Computer Organization
CSCI 4753 (3) Computer Performance Modeling
CSCI 4838 (3) User Interface Design

ECEN 1400 (3) Introduction to Digital and Analog Electronics
ECEN 2060 (3) Sp Top: Renewable Energy
ECEN 2120 (5) Computers as Components
ECEN 2250 (5) Circuits/Electronics 1
ECEN 2260 (5) Circuits/Electronics 2
ECEN 3030 (3) Electrical/Electronic Circuits Non-Major
ECEN 3100 (5) Digital Logic
ECEN 3170 (3) Energy Conservation 1
ECEN 3250 (5) Circuits/Electronics 3
ECEN 3300 (5) Linear Systems
ECEN 3320 (3) Semiconductor Devices
ECEN 3400 (5) Electromagnetic Fields and Waves
ECEN 3410 (3) Electromagnetic Waves and transmission
ECEN 3810 (3) Introduction to Probability Theory
ECEN 4021 (3) Sp Top: Design Med Device
ECEN 4106 (3) Photonics
ECEN 4109 (3) Very Large Scale Integrated System Design
ECEN 4120 (3) Neural Network Design
ECEN 4138 (3) Control Systems Analysis
ECEN 4167 (3) Energy Conservation 2
ECEN 4242 (3) Communication Theory
ECEN 4345 (3) Introduction to Solid State
ECEN 4517 (2) Power Electronics Laboratory
ECEN 4532 (3) Digital Signal Processing Laboratory
ECEN 4553 (3) Introduction to Complier Construction
ECEN 4583 (3) Software System Development
ECEN 4593 (3) Computer Organization
ECEN 4606 (3) Undergraduate Optics Laboratory
ECEN 4613 (3) Embedded System Design
ECEN 4616 (3) Optoelectric System Design
ECEN 4623 (3) Real Time Embedded Systems
ECEN 4632 (3) Introduction to Digital Filtering
ECEN 4633 (2) Hybrid Embedded System
ECEN 4634 (2) Microwave and RF Laboratory
ECEN 4645 (3) Introduction to Optical Electronics
ECEN 4652 (2) Communication Laboratory
ECEN 4753 (3) Computer Performance Modeling
ECEN 4797 (3) Introduction to Power Electronics
ECEN 4811 (3) Neural Signals & Functional Brain Imaging
ECEN 4821 (3) Neural Systems and Physiological Control
ECEN 4827 (3) Analog IC Design
ECEN 4831 (3) Brains, Minds, Computers

EMEN 4030 (3) Project Management System
EMEN 4050 (3). Leadership
EMEN 4825 (3). Entrepreneurial Business Plan Preparation
EVEN 2840 (1-3) Independent Study
EVEN 4100 (3) Environmental Sampling and Analysis * †
EVEN 4840 (1-3) Independent Study

GEEN 3400 (3) Invention and Innovation

MCEN 1025 (3). Computer-Aided Design and Fabrication
MCEN 1208 (3) Sp Top: Sustainable Energy
MCEN 2024 (3) Materials Science
MCEN 3017 (3) Circuits and Electronics
MCEN 3030 (3) Computational Methods
MCEN 3043 (3) Dynamics
MCEN 4026 (3) Manufacturing Processes and Systems
MCEN 4042 (3) Thermal Systems Design
MCEN 4043 (3) System Dynamics
MCEN 4120 (3) Engineering Statistics
MCEN 4122 (3) Thermodynamics 2
MCEN 4124 (3) Mechanical Behavior of Materials
MCEN 4134 (3) Biomechanics
MCEN 4141 (3) Indoor Air Pollution
MCEN 4152 (3) Introduction to Combustion
MCEN 4162 (3) Energy Conversion
MCEN 4173 (3) Finite Element Analysis
MCEN 4228 (3) Sp Top: Climate Solutions
MCEN 4228 (3) Sp Top: Energy Conservation and Storage
MCEN 4228 (3) Sp Top: Environmental Modeling
MCEN 4228 (3) Sp Top: Renewable and Sustainable Energy
MCEN 4228 (3) Sp Top: Wind Energy

Table of Prerequisites and co-requisites for required courses in the EVEN BS curriculum.

course no.	course name	prerequisites	co-requisites
APPM 1350	Calculus 1 for Engineers	2 yrs HS algebra, 1 yr geometry, ½ yr trigonometry	
APPM 1360	Calculus 2 for Engineers	APPM 1350 or MATH 1300	
APPM 2350	Calculus 3 for Engineers	APPM 1360 or MATH 2300	
APPM 2360	Intro Diff Eqns with Linear Algebra	APPM 1360 or MATH 2300 (min. grade C)	
APPM 4570	Statistical Methods	APPM 1360 or equiv	
AREN 2110	Thermodynamics	PHYS 1110	APPM 1360
ATOC 1070	Weather and the Atmosphere Laboratory	ATOC 1050 or instr consent	ATOC 1050
CHEM 1221	General Chemistry Laboratory	high school chemistry & algebra or CHEM 1001 or 1021	CHEN 1211
CHEM 4521	Physical Chemistry for Engineers	CHEN 1211/CHEM 1221 or CHEM 1111-CHEM 1131; APPM2350; PHYS 1110 or instr consent	PHYS 1120
CHEN 1211	General Chemistry for Engineers	high school chemistry & algebra or CHEM 1001 or 1021	CHEM 1221
CHEN 2120	Chem Engr Matl Energy Balances	CHEN 1211, GEEN 1300	
CHEN 3010	Applied Data Analysis	GEEN 1300, APPM 2360	
CHEN 3200	Chem Engr Fluid Mechanics	APPM 2350, CHEN 2120 or MCEN 2023	APPM 2360
CHEN 3210	Chem Engr Heat Transfer	CHEN 2120, GEEN 1300, Fluid Mechanics	
CHEN 3320	Chem Engr Thermodynamics	CHEN 2120, CHEM 4521 or 4511	
CVEN 2121	Analytical Mechanics 1	PHYS 1110, APPM 2350	APPM 2350
CVEN 3227	Probability, Statistics & Decisions	APPM 2360, JR standing	
CVEN 3313	Theoretical Fluid Mechanics	CVEN 2121	
CVEN 3414	Fundamentals of Environmental Engr	CHEN 1211, APPM1360	
CVEN 3454	Water Chemistry	CHEN 1211 or CHEM 1111-1131, CVEN 3414	
CVEN 3708	Geotechnical Engineering	CVEN 3161	
CVEN 4147	Engineering Economy and System Design	SR (or JR) standing	
CVEN 4333	Engineering Hydrology	CVEN 3227, CVEN 3323 (or fluid mechanics)	
CVEN 4424	Environmental Organic Chemistry	CHEN1211 or CHEM 1111-1131	
CVEN 4434	Environmental Engineering Design	CVEN 3414	
CVEN 4444	Environmental Engineering Processes	CVEN 3414	
CVEN 4484	Intro to Environmental Microbiology	CHEM 1211, CHEN 1221, APPM 2350	
EMEN 4100	Business Methods and Economics for Engr	JR/SR standing	
EVEN 1000	Intro to Environmental Engineering	none	
EVEN 4100	Environmental Sampling and Analysis	CVEN 3454 & 4424 or equiv.	
EVEN 4830	Technoeconomics Analysis for Env Engr	CHEN 1211, APPM 2360, PHYS 1120 or equivalents	
GEEN 1300	Intro to Engineering Computing	none	APPM 1350
GEEN 1400	Engineering Projects	none	
GEEN 3851	Statics for Engineers	PHYS 1110	recom APPM 2350
GEEN 3852	Thermodynamics for Engineers	APPM 2350	
GEEN 3853	Fluid Mechanics for Engineers	APPM 2350 or 2360, GEEN 1300 or CSCI 1300	
GEOG 4411	Methods of Soil Analysis	GEOG 1001-1011, GEOG 4401	GEOG 4401
GEOL 2700	Intro to Field Geology	GEOL 1010-1020, or GEOL 1060-1070 or GEOG 1001-1011	
GEOL 3010	Intro to Mineralogy	CHEM 1111, MATH 1300 (or CHEN 1211, APPM 1350)	
GEOL 4716	Environmental Field Geochemistry	GEOL 2700, chemistry sequence	
MCEN 2023	Statics and Structures	APPM 1360	
MCEN 3012	Thermodynamics	APPM 2350	
MCEN 3021	Fluid Mechanics	APPM 2360, Solid Mechanics	
MCEN 3022	Heat Transfer	MCEN 3012 & 3021 (or fluid mechanics & thermodynamics)	
MCEN 4131	Air Pollution Control	fluid mechanics	
PHYS 1110	General Physics 1	none	APPM 1350
PHYS 1120	General Physics 2	PHYS 1110	APPM 1360, PHYS 1140
PHYS 1140	Experimental Physics 1	PHYS 1110 or Phys 1120	PHYS 1120

*or by instructor's consent as arranged by the Environmental Engineering Program

For prerequisites for option courses, see p. 8.

Useful Websites

Environmental Engineering Program: http://www.colorado.edu/engineering/EnvEng/

College of Engineering and Applied Science: http://engineering.colorado.edu/

Academic Support Programs: http://engineering.colorado.edu/academics/support.htm

Active Learning Program: http://engineering.colorado.edu/activelearning/index.htm

Co-op Program: http://engineering.colorado.edu/activelearning/co-op.htm

Discovery Learning (includes Discovery Learning Apprenticeship Program, Undergraduate Research Opportunities Program (UROP), Bioscience Undergraduate Research Skills and Training (BURST), Research Experience for Undergraduate (REU)): http://engineering.colorado.edu/activelearning/aboutdiscovery.htm

Service Learning (includes Earn-Learn Apprenticeship Program, Engineering for Developing Communities, Engineers Without Borders, etc): http://engineering.colorado.edu/activelearning/service.htm

Professional Learning (includes internships and co-ops): http://engineering.colorado.edu/activelearning/professional.htm

Advising Guides: http://engineering.colorado.edu/students/advising.htm

Career Services: http://careerservices.colorado.edu

Catalog, University of Colorado at Boulder: http://www.colorado.edu/catalog/catalog08-09/

Course Repetition Policy: http://registrar.colorado.edu/students/registration/course_repetition.html

Engineering Center Maps: http://www.cs.colorado.edu/department/maps/ or http://www.cs.colorado.edu/department/maps/ec.html

FE Exam: National Council of Examiners for Engineering and Surveying http://www.ncees.org/
State of Colorado Board of Licensure: http://www.dora.state.co.us/aes/index.htm

Forms (for College of Engineering: Petition form, Change of Major Form, etc.): http://engineering.colorado.edu/students/advising.htm

Humanities and Social Sciences Requirements:
(Fall 2007 and later): http://engineering.colorado.edu/homer/Fall2007.htm
(Pre-summer 2007): http://engineering.colorado.edu/homer/Prefall2006.htm

Minors: http://www.colorado.edu/ArtsSciences/students/undergraduate/academics/minors.html

Office of the Registrar: http://registrar.colorado.edu/

Schedule of Courses: http://plus.colorado.edu/planner/
or through CUConnect: http://cuconnect.colorado.edu

Student Society for Environmental Engineering: http://www.colorado.edu/engineering/EnvEng/SEVEN.htm

Transfer students, information for: http://engineering.colorado.edu/prospective/transfer_students.htm
Transfer Credits: http://engineering.colorado.edu/prospective/transfer_credits.htm
GTPathways curriculum: http://highered.colorado.gov/Academics/Transfers/gtPathways/curriculum.html

Undergraduate Student Services: http://ecadw.colorado.edu/engineering/students/undergraduate.htm