Environmental Engineering Degree Program Guidelines

Academic Year 1998-1999

Environmental Engineering Program
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(revised: August 3, 1998)

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1 OVERVIEW AND GENERAL INFORMATION

1.1 Environmental Engineering at CU Boulder

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, and prevention of pollution through product or process design.

To address these challenges, environmental engineers work in an exciting, multidisciplinary arena. Solutions to many environmental problems require contributions from engineers, 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.

The Bachelors of Science degree program in environmental engineering includes coursework in advanced mathematics, biology, chemistry and physics. In common with other engineering fields, courses in solid mechanics, fluid dynamics and thermal sciences are central to the environmental engineering degree. Coursework that is specific to environmental engineering includes water and wastewater treatment, hazardous waste storage and treatment, and air pollution control. In addition, environmental engineering requires hands-on water, soil and air quality laboratory experience, up-to-date skills in the use of computers for modeling and data analysis and experience in the design of environmental engineering systems.

To cover the broad base of knowledge required of environmental engineers, the degree program at CU draws on the expertise of more than 20 faculty from four departments: aerospace engineering; civil, environmental and architectural engineering; chemical engineering and mechanical engineering. The required engineering courses in the program are offered in these four departments. Technical elective courses include three selected from a broad range of science and engineering courses, and four that are organized according to tracks in water and wastewater engineering; air quality engineering; chemical processing; and general environmental engineering. Students in the program are also encouraged to participate in summer internships and in research at CU through independent study projects, the Undergraduate Research Opportunities Program (UROP) or as research assistants in sponsored programs.

Information and materials on application to the Environmental Engineering Program can be obtained from the Office of Admissions, Campus Box 30, University of Colorado, Boulder, CO 80309-0030.

For further information about the Environmental Engineering Program, contact Professor Jana Milford, Program Director, Campus Box 427, University of Colorado, Boulder, CO 80309-0427. Email: milford@spot.colorado.edu. Phone: (303) 492-5542.

1.2 Courses and Curriculum Requirements

These guidelines are intended for the use of Environmental Engineering undergraduate students. Students should also consult the various guides and publications available from the Engineering Dean's Office regarding College policies. Information on courses offered each semester is available in the Registration Handbook and Schedule of Courses published by the University.

The curriculum is by nature dynamic, and consequently undergoes both major and minor changes. Students are generally expected to follow the curriculum in effect when they entered as freshmen. **You should keep a copy of the university catalog and all written information including the version of the *Undergraduate Program Guidelines* that was in effect when you entered the Environmental Engineering Program**. Copies of the curriculum, a course checklist and a graphical flow chart are contained in this document.

1.3 Undergraduate Program Advising

The Environmental Engineering faculty believe that every Environmental Engineering student must have access to quality advising. All students are strongly urged to take advantage of the opportunity to discuss academic issues of concern with their faculty advisor. **Karen Hebbel (ECME 251)** is the EVEN undergraduate advising coordinator. She will provide assistance on procedural questions including course registration, degree plans, graduation requirements, and the petition process. In addition, she will help students determine whether a particular situation should be discussed with their faculty advisor. She is normally the first point of contact for advising.

Faculty Advisor

Upon entering the program, students will be assigned a faculty advisor who will follow them through their studies. Advising assignments for the 1998-99 academic year are:

Class	Professor	Room No.	Email Address
Freshmen *(£ 30 hrs)*	Jana Milford	ECME 222	milford@spot.colorado.edu
Sophomores *(>30, £ 60hrs)*	Shelly Miller	ECME 226	shellym@stripe.colorado.edu
Juniors *(>60, £ 90 hrs)*	Mark Hernandez	ECOT 518	hernando@stripe.colorado.edu

Seniors *(>90 hrs)*			
Transfers	Jana Milford	ECME 222	milford@spot.colorado.edu

Students are encouraged to meet with their faculty advisor to discuss issues such as academic progress, course content, and for career consultation. Another important resource available to students is **Counseling Services, 134 Willard Hall, 2-6766,** which provides a variety of programs and assistance to address general academic or personal issues .

During the middle portion of each semester, course selection and registration for the following semester takes place. The requirement for a meeting with a faculty advisor prior to registration depends on a student's progress in their undergraduate program. Details regarding the specific registration procedures for each class will be provided at the appropriate time.

Transfer Advisor

Once transfer and advanced placement (AP) credit evaluations have been completed by the university, the applicability of these credits towards the undergraduate Environmental Engineering program is determined by the Transfer Credit Evaluator, **Prof. Jana Milford (ECME 222).** In some cases, students will need a catalog description and syllabus for a prior course. Students can arrange for a transfer credit evaluation by making an appointment with the Undergraduate Student Advising Coordinator.

Student Files and Information

Each student has an official Environmental Engineering department folder which is kept in the program office. This folder contains copies of official documentation related to student academic history and progress. In general, this folder should be brought to every advising session. **The burden of proof lies with the student for all matters related to the satisfactory completion of graduation requirements. Consequently, you should ensure that all copies of relevant paperwork are placed in your program folder. In addition, you should keep a separate copy of critical information.**

E-mail Instructions

All students are required to subscribe to the EVEN undergraduate e-mail list, which will be used to distribute the latest information regarding program policies, curriculum issues, registration and graduation procedures, along with job/internship opportunities and other program announcements. Instructions to subscribe are: send email to **listproc@lists.Colorado.EDU**, and in the "body" type **subscribe even-students** followed by your full name e.g., *subscribe even-students Chris. J. Smith.* To unsubscribe, simply type in the body **unsubscribe even-students**.

2 ENVIRONMENTAL ENGINEERING CURRICULUM

2.1 Approved Curriculum for the B.S. Degree in Environmental Engineering 1998-1999

Freshman – Fall		Freshman – Spring	
APPM 1350 Calculus I	(4)	APPM 1360 Calculus II	(4)
CHEM 1211 General Chemistry	(3)	GEEN 1400 Engr Projects	(3)
CHEM 1221 General Chemistry Lab	(2)	PHYS 1110 Physics I	(4)
GEEN 1300 Intro to Engr Computing	(3)	H&SS Elective II	(3)
GEEN 1500 Engineering Intro Course	(1)		
H&SS Elective I[a]	(3)		
Total credits	16		14

Sophomore – Fall		Sophomore – Spring	
APPM 2350 Calculus III	(4)	CVEN 3414 Intro to Env Engr	(3)
PHYS 1120 Physics II	(4)	APPM 2360 Diff Eqns	(4)
PHYS 1140 Experimental Physics	(1)	Fluid Mechanics I[c]	(3)
Mechanics I[b]	(3)	CHEM 3311 Organic Chem	(3)
CHEN 2120 Matl and Energy Balances	(3)	CHEM 3321 Organic Lab	(1)
---	--	H&SS Elective III	(3)
Total credits	15		17

Junior – Fall		Junior – Spring	
Heat Transfer I[d]	(3)	CHEN 3320 Thermodynamics	(3)
CHEM 4511 Physical Chemistry	(3)	Probability & Statistics[g]	(3)
CVEN 3454 Water Qual. Lab	(4)	CHEN 3220 Princ. 3 (Mass Trans)	(4)
Option Course I[e]	(3)	Option Course II	(2-3)
Technical Elective I[f]	(3)	UWRP 3030 Writing on Sci.[h]	(3)
Total credits	16		15-16

Senior – Fall		**Senior – Spring**	
CVEN 4484 Environmental Microbiology	(3)	Numerical Methods[i]	(3)
CHEN 4330 Reaction Kinetics	(3)	CVEN 4333 Hydrology	(3)
CVEN 4434 Envir. Eng. Design	(3)	MCEN 4121 Air Pollution Control	(3)
Option Course III	(2-3)	Option Course IV	(3)
Technical Elective II	(3)	Technical Elective III	(3)
H&SS Elective IV	(3)	H&SS Elective V	(3)
Total credits	17-18		18

Total credits = 128 for chemical processing and general tracks, 129 for air quality track, 130 for water and wastewater track.

Notes:
[a]A total of 18 credit hours of humanities and social sciences (H&SS) electives is required. At least six hours must be at the upper division (3000 or 4000) level. UWRP 3030 or GEEN 3000 may be counted toward three hours of upper division H&SS elective credit.
[b]Mechanics I: CVEN 2121 Analytical Mechanics I or MCEN 2023 Mechanics of Particles
[c]Fluid Mechanics I: CVEN 3313, MCEN 3021 or CHEN 3200
[d]Heat Transfer: MCEN 3022 or CHEN 3210 (4 Cr.)
[e]Option courses are specified below for the Water and Wastewater, Air Quality and Chemical Processing tracks. Option courses for the General Track may be selected from any of these three lists, with the provision that a total of 10 credits be taken.
[f]Technical elective courses should be 3000/4000 level courses in engineering, mathematics or the sciences, and have substantially different content than required courses.
[g]Probability and Statistics: CVEN 3227 or CHEN 3010
[h] GEEN 3000 may be substituted for UWRP 3030.
[i]Numerical Methods: MCEN 4030, CVEN 4537, ASEN 4417 or CHEN 4580

2.2 Option Courses

Option Courses for Water and Wastewater Track:

CVEN 3323 Hydraulic Engineering (3 Cr., Fall Year 3)
CVEN 3424 Water and Waste Water Treatment (3 Cr., Spring Year 3)
CVEN 4474 Hazardous Waste (3 Cr., SpringYear 4)
Or CVEN 4353 Groundwater Engineering (3 Cr. Fall, Year 4)
CVEN 4423 Water Res. Engr. Design (3 Cr., Spring Year 4)

Option Courses for Air Quality Track:

ATOC 3500 Air Chemistry and Pollution (3 Cr., Fall Year 3)
Or ATOC 4710 Atmospheric Physics (3 Cr., Fall Year 3)
CHEM 4541 Physical Chemistry Lab (2 Cr., Spring Year 3)
MCEN 4228 Indoor Air Quality (3 Cr., Fall Year 4)
MCEN 4162 Energy Conversion or MCEN 4228 Intro. to Combustion (3 Cr.)

Option Courses for Chemical Processing Track:

CHEM 3331 Organic Chemistry 2 (3 Cr., Fall Year 3)
CHEM 3130 Chemical Engineering Laboratory 1 (2 Cr., Spring Year 3)
CHEN 4130 Chemical Engineering Laboratory 2 (2 Cr., Fall Year 4)
CHEN 4670 Environmental Separations

Or CHEN 4680 Environmental Process Engineering (3 Cr.)

ENVIRONMENTAL ENGINEERING - DEGREE REQUIREMENTS WORKSHEET Fall 1998

Name: _____ Student#:_____

Advisor: _____ Date: _____

D.Maj./O.Opt./Equiv. Transfer Record CU Record

			Course Name	Course#/Credit	Term	Grade
REQUIRED COURSES						
Engineering (54 hrs)						
GEEN 1300	[3]	Intro Engr Computing		/____		
GEEN 1400	[3]	Engineering Projects		/____		
GEEN 1500	[1]	Intro to Engineering		/____		
	[3]	Mechanics I		/____		
CHEN 2120	[3]	Matl/Energy Balances		/____		
CVEN 3414	[3]	Intro Envr Engr		/____		
	[3]	Fluid Mechanics		/____		
	[3]	Heat Transfer		/____		
CVEN 3454	[4]	Water Quality Lab		/____		
CHEN 3320	[3]	ChE Thermodynamics		/____		
CHEN 3220	[4]	ChE Principles 3 (Mass Transfer)		/____		
	[3]	Probability and Statistics		/____		
	[3]	Numerical Methods		/____		
CVEN 4484	[3]	Envr Microbiology		/____		
CHEN 4330	[3]	Reaction Kinetics		/____		
CVEN 4434	[3]	Envr Eng Design		/____		
CVEN 4333	[3]	Eng Hydrology		/____		
MCEN 4121	[3]	Air Pollution control		/____		
Mathematics (16 hrs)						
APPM 1350	[4]	Calculus for Engineers I		/____		
APPM 1360	[4]	Calculus for Engineers II		/____		
APPM 2350	[4]	Calculus for Engineers III		/____		
APPM 2360	[4]	Intro Linear Algebra & Diff. Eqn.		/____		
Physical Sciences (21 hrs)						
CHEM 1211	[3]	General Chemistry		/____		
CHEN 1221	[2]	General Chemistry Lab		/____		
PHYS 1110	[4]	General Physics		/____		
PHYS 1120	[4]	General Physics II		/____		
PHYS 1140	[1]	Experimental Physics		/____		

CHEM 3311 [3] Organic Chemistry _____ _____/____
_____ ____
CHEM 3321 [1] Organic Lab _____ _____/____
_____ ____
CHEM 4511 [3] Physical Chemistry _____ _____/____
_____ ____

ELECTIVE COURSES

Humanities & Social Science Electives (18 hrs, 6 hrs upper division)

1. UWRP 3030 [3] Writing on Science_____(UD) _____ _____/____
_____ ____
2. _____ _____/____
_____ ____
3. _____ _____/____
_____ ____
4. _____ _____/____
_____ ____
5. _____ _____/____ _____ ____
6. _____(UD) _____/____
_____ ____

Option Courses (10-12 hrs)

1. _____ _____/____
_____ ____
2. _____ _____/____
_____ ____
3. _____ _____/____
_____ ____
4. _____ _____/____
_____ ____

Technical Electives (9 hrs)

1. _____ _____/____
_____ ____
2. _____ _____/____ _____ ____
3. _____ _____/____ _____ ____

3 GRADUATION REQUIREMENTS

3.1 Minimum Requirements

To be eligible for 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 prescribed and elective work as determined by the Environmental Engineering Program. A student must complete a minimum number of 128 semester hours, of which the last 45 shall be earned after admission to the University and the College as a degree student.

2. A minimum cumulative grade point average of 2.00 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 (program) grade point average of 2.00. This major grade point average is computed separately from the student's cumulative grade point average and includes only course work in engineering courses.

4. Successful completion of the Minimum Academic Preparation Standards (MAPS) requirement of the College.

5. Successful completion of UWRP 3030, *Writing on Science and Society* or GEEN 3000, *Professional Communications for Engineers*. Students participating in the first full year of the Herbst Program of Humanities for Engineers 1 and 2 (HUEN 3100 and 3200) are exempted from this requirement.

6. Completion of either the Fundamentals of Engineering (FE) examination or the Graduate Record Examination (GRE; both General and Engineering tests) during the final academic year.

7. Submission of a completed Diploma Card which is available in the Dean's Office.

Failure to complete the requirements listed above will postpone graduation. Any exceptions will require authorization of the Environmental Engineering Program director and the Dean's Office. You should meet with your departmental advisor the semester prior to your planned graduation to review your records.

*BECAUSE THE **BURDEN OF PROOF** IS ON YOU, CONSULT THE PROGRAM CHAIR, YOUR FACULTY ADVISOR, OR THE UNDERGRADUATE ADVISING COORDINATOR, AND PETITION FOR APPROVAL OF ANY PROGRAM DEVIATIONS.*

Fundamentals of Engineering and Graduate Record Exams

To graduate with a B.S. degree in Environmental Engineering, students must take either the Fundamentals of Engineering (FE) exam or the Graduate Record Examination (GRE - both the General and the Engineering subject tests). The Dean’s Office will reimburse the registration fee for either exam.

These tests assist the Environmental Engineering Program in meeting its assessment requirements, and are also valuable for engineering careers. The FE exam is the first step toward professional engineering registration, a particularly important credential for engineers working as consultants. Passing the FE exam is easiest in college, when the material covered is relatively fresh! The GRE exam is required by many institutions for application to graduate school. Some students will benefit from taking both exams. Students can register for the FE exam in the Dean's Office, usually in February of your last academic year. Registration for the GRE, which is usually taken in the fall before graduation, is done through the Office of Counseling and Career Services, Willard 134, 2-0343.

3.2 Double Majors

Students may double major if they satisfy the requirements of both curricula and if they take a minimum of 30 hours beyond the higher degree requirement, i.e., 158 hours total. If a student can satisfy both degree requirements with fewer than 30 additional hours, the difference can be made up with free electives.

3.3 Additional Considerations

- Students taking more than 18 hours in a semester will be assessed a tuition surcharge.
- Only 4 credit hours each will be allowed for MATH 1300-5 and MATH 2300-5.
- CHEN 2100 does not satisfy the requirement for CHEM 1211 and CHEN 1221.

4 ENVIRONMENTAL ENGINEERING POLICIES

4.1 Pre-Requisite and Co-Requisite Courses

It is the policy of the Environmental Engineering Program that students must successfully satisfy all pre-requisite course(s) (PRC) and associated co-requisite course(s) (CRC) before a subsequent required course is taken.

The required Environmental Engineering courses and the corresponding PRC and CRC requirements are listed below.

Successful completion of a PRC or CRC course requires a grade of C- or better. Grades of D+, D, D-, *F, IF, or IW* do not satisfy the requirement.

PRC and CRC requirements for all Environmental Engineering required courses will be monitored, however it is the **student's responsibility** to re-take those courses below a grade of C-. Should that be the case, the student is strongly urged to consult with his/her faculty advisor prior to registering for the next required course.

Courses not listed in the approved curriculum may be used to satisfy PRC and/or CRC requirements if (1) transfer credit has been awarded, or (2) a petition to the Advising Committee has been approved.

This policy applies only to Environmental Engineering *required courses*. If a student has not satisfied all of the PRC and CRC requirements for a particular *technical elective* course, that course may be taken with the approval of the instructor.

Pre-Requisites for Required Environmental Engineering Courses

Course Number	Course Name	Prerequisites
GEEN 1300	Intro Engr. Computing	None
GEEN 1400	Engr. Projects	None
MCEN 2023	Mechanics of Particles	APPM 1360
Or CVEN 2121	Analytical Mechanics I	PHYS 1110, APPM 2350 (co-req)
CHEN 2120	Matl and Energy Balances	CHEM 1211, GEEN 1300
CVEN 3414	Intro to Envr Engr.	CHEM 1211, APPM 2350
MCEN 3021	Fluid Mechanics	MCEN 2023, APPM 2360
Or CVEN 3313	Theoretical Fluid Mechanics	CVEN 2121 (or equiv.)
Or CHEN 3200	Chemical Engr Principles I	CHEN 2120, APPM 2350
CHEN 3210	Chemical Engr Principles II	CHEN 3200 (or equiv.)
Or MCEN 3022	Heat Transfer	MCEN 3012, 3021 (or equiv.)
CVEN 3454	Water Quality Lab	CVEN 3414
CHEN 3320	Thermodynamics	CHEM 4511
CHEN 3220	Chemical Engr Principles III	CHEN 3200, CHEN 3210 (or equiv.)
CVEN 4484	Envr Microbiology	instructor's permission
CHEN 4330	Reaction Kinetics	CHEN 3210 (or equiv), CHEN 3320
CVEN 4434	Envr Eng Design	CVEN 3454
CVEN 4333	Eng Hydrology	instructor's permission
MCEN 4121	Air Pollution Control	MCEN 3021, 3022 (or equiv.)

4.2 Transfer Credit

The initial transfer credit evaluation is performed by the University Admissions Office upon receiving an official transcript mailed directly from the institution in which the credit was earned. Once the Admissions Office has completed its evaluation, the Environmental Engineering Program Transfer Credit Evaluator will determine what courses apply to the department's curriculum. The Admissions Office will not accept courses in which the student received a grade lower than a "C-."

All transfer students are advised to contact the Environmental Engineering Program **Transfer Credit Evaluator (Prof. Milford**) about acceptance of transfer credits upon their enrollment in the College of Engineering and, if possible, before making up a course schedule.

Rules for the College of Engineering require that the last 45 semester credit hours used to fulfill degree requirements must be taken as a regular degree student in the College of Engineering on the Boulder campus.

Advanced Placement AP credit may be approved on the basis of College Entrance Examination Board's Advanced Placement tests. For students who have taken advanced placement courses in high school and who make the required score in the CEEB's AP examination, college credit will be granted if the subject would normally satisfy part of the student's curriculum. If a student elects to take the equivalent college course, the credit for that course will replace the AP credit. For a listing of CU course equivalents, see the college Advising Guide entitled Advanced Placement and MAPs, or the *University of Colorado Catalog.* AP credit is handled as transfer credit.

The maximum number of credit hours taken through the Division of Continuing Education (SAVE, Boulder Evening, correspondence) that can be applied toward degree requirements is 16, with no more than eight hours in the humanities or social sciences. For the most part, course work completed through Boulder Evening can only be applied toward the humanities and social sciences elective requirement unless otherwise petitioned. **Students must secure advance approval of the Environmental Engineering Program and the Dean's Office prior to registering for Continuing Education courses.**

Except for courses on basic subjects including mathematics, physics, and humanities, credits from an engineering technology program normally will not transfer.

Students pursuing a double degree must have transfer credit evaluations performed by each department involved. Additionally, intra-university transfer (IUT) students must have a transfer credit evaluation done by their new major department.

No academic credit will be granted for work or co-op experience.

4.3 Humanities and Social Science Courses

The purpose of humanities and social sciences (H&SS) electives is to broaden education with courses in literature, the social sciences, or the humanities. The H&SS electives should provide both breadth and depth rather than just a random selection of unrelated introductory courses. Consequently, students should follow a well-posed plan that reflects meaningful groupings of the H&SS electives. Guidance as to the selection process as well as appropriate courses for consideration is provided in the College of Engineering Humanities and Social Sciences booklet which can be obtained from the EVEN Undergraduate Advising Coordinator and/or from the College of Engineering and Applied Sciences web-site (click on Undergrad Program Overview). Students are urged to discuss their plan and course selections with **Marie Gingras, Humanities & Social Science Advisor, Room ECOT 611, 492-2862, e-mail: marie.gingras @colorado.edu**, the EVEN Undergraduate Advising Coordinator or their faculty advisor.

Requirements

A total of 18 credit hours of H&SS electives is required for graduation. At least six of the required credit hours must be at the upper division level (3000 or 4000 numbered courses). In accordance with the rules of the College of Engineering and Applied Science, UWRP 3030 (Writing on Science) or a comparable level writing course in the University Writing Program is required of all students and provides three hours of upper division credit. The writing class requires only junior standing (≥ 60 semester credit hours) as a formal pre-requisite.

Courses taken within the Herbst Humanities Program count towards the H&SS requirements. Students completing the first full year of the Herbst Humanities Program (HUEN 3100 and HUEN 3200), are not required to take UWRP 3030. GEEN 3000, Professional Communications for Engineers, may also be substituted for UWRP 3030.

The first seminar in the Minority Engineering Program (GEEN 1510) provides one hour of lower division H&SS credit; the second course (GEEN 1520) provides no credit.

A list of acceptable H&SS courses is published by the college. A petition is required to obtain credit for a course that is not on the list. It is strongly suggested that the petition be approved before enrolling in the course.

Foreign language courses generally satisfy the humanities and social science requirements.

Unacceptable Courses for H&SS Credit

Generally, performance courses, as well as natural science and mathematics courses taken outside of engineering or mathematics, are not acceptable as H&SS electives. The following courses are **specifically excluded** as satisfying H&SS requirements:

- Intro Mathematical Economics
- Intro Economic Statistics
- Calculus for Economists
- Painting, Sculpture, Photography, etc.
- Musical Instruments, Band, Choir, etc.
- Business Courses such as accounting, finance, personnel administration, etc.
- Science Courses such as Geology, Biology, etc.
- Communications
- Kinesiology

Herbst Program Humanities Seminar

Thanks to an endowment from CU alumnus Clancy Herbst, Jr., the College of Engineering and Applied Science offers a small number of students a specialized program of four 3-credit courses in the humanities. Herbst program classes are conducted in a seminar setting, with 14 students and two

faculty moderators. Students gain experience in speaking, writing and thinking critically, while studying masterpieces from various fields of human achievement. The Herbst program is a two-year program beginning in the student's junior year, with admission by application during the spring semester of the sophomore year. For more information, contact the Herbst Program office in ECOT 417, 2-570.

4.4 Technical Electives

Technical electives provide an opportunity for students to explore a range of subjects, (engineering, mathematical, and the natural sciences), to provide increased breadth or to focus on a specific technical area to develop in-depth understanding. Although a student has great latitude in selecting elective, students are strongly encouraged to use technical electives credits wisely to complement their undergraduate engineering experience. Students should consult their faculty advisors to plan their elective program.

The general rule is that technical elective courses should be 3000/4000 level within engineering, mathematics, sciences, and have a substantially different content than EVEN required courses. Exceptions to this rule will be considered by petition to the Advising Committee. Double-listed courses, ie. 4000/5000 level, may be taken as technical electives; these courses have a separate set of requirements for undergraduate students. Graduate level courses (5000 level) may also be taken as technical electives; admission to graduate courses requires the consent of the instructor.

Possibilities and Limitations

- A maximum of 6 hours of independent study (see section 4.7), will be accepted as technical elective credit.
- Upon commissioning, up to 3 hours of ROTC courses may be used as a technical elective.
- Communications and foreign languages do not count as technical electives.
- A technical elective may be taken pass/fail ONLY IF IT IS NOT REQUIRED FOR GRADUATION.

4.5 One Time Forgiveness Policy

This policy provides the means for correcting a significant registration error **once,** and is used in conjunction with a detailed College petition which can be obtained from the Undergraduate Advising Coordinator. This policy does NOT apply to students on academic probation.

4.6 Independent Study

Independent Study is an opportunity for students to earn academic credit for learning outside the formal class structure, under the individual direction of a faculty member. Independent Study is provided to fill an academic need of importance to the student that cannot be filled by the regular curriculum.

EVEN students may apply up to **six** credit hours of Independent Study towards an Environmental Engineering degree. Upon satisfactory completion of a first three-hour independent study experience, a student may petition to take a second three-hour independent study course.

An Independent Study is normally supervised by an Environmental Engineering faculty member, but may be supervised by any appropriate University of Colorado faculty member, if the following program requirements are met.

Independent Study Requirements

1. Submission of an Independent Study Agreement Form (which includes a written Statement of Work), to the EVEN Undergraduate Advising Coordinator. This paperwork must be submitted by the course drop/add deadline as specified in the Registration Handbook and Schedule of Courses.

2. Satisfactory completion of a significant portion of the initially defined project. CCHE policy states that a minimum of 25 hours of work-time on the part of the student is required for each 1 semester hour of Independent Study credit.

3. A written final report, including a copy for Environmental Engineering Program files, must be submitted before a grade will be sent to the registrar's office for posting.

4. A second independent study must be approved by petition PRIOR to the submission of the independent study form. *Note: a copy of the previous approved independent study form should be attached.*

5. **Under no circumstances will a third independent study be allowed.**

Restrictions

University rules do not allow Independent Study credit for: internship experiences; for work-study or hourly pay work done in departments; for work also compensated by a salary.

Independent Study is to be enrolled for in the same time frame as all other courses.

The Independent Study may not be done retroactively. That is, the agreement for Independent Study is to be completed, signed, and approved prior to ***the initiation of the project.***

How to Enroll

After completion and approval of the Independent Study Agreement, the student will need to contact the Undergraduate Advising Coordinator for the call number to register. Registration for Independent

Study normally cannot be arranged after the second week of classes in any semester.

College of Engineering and Applied Science
Environmental Engineering Program

Independent Study Agreement

Name: _____ Student number:_____

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

Class standing:Sophmore, Junior, Senior, 5th Yr Sr (circle one) Local phone / email:_____

Major: _____ Overall GPA:_____

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

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

Faculty member: _____ Course #:_____

Description and goals of the proposed Independent Study:

_____
Signature of Supervising Faculty Member

Registered by_____ Date_____
Undergraduate Advising Coordinator

4.7 Study Abroad Opportunities

The University of Colorado offers numerous Study Abroad Opportunities through the Office of International Education. Many engineering students participate in these programs for a summer, semester, or year, often finding them to be life-transforming experiences. In some cases, students focus on language and humanities courses offered by the foreign institution. In other cases, technical courses taken abroad may satisfy specific requirements in the Environmental Engineering curriculum. For more information, contact the Office of International Education, ENVD 1B01, 2-7741.

4.8 Petitions

Any exceptions to or waivers of departmental or college rules must have prior approval by petition. The petition must be completed and submitted to the Environmentall Engineering Program for approval; the petition will then be forwarded to the Dean's Office. It is best to petition and "get it in writing" whenever a variance to rules or procedures is involved. **It is the student's responsibility to follow up on the petition's progress**.

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

- Enrolling in a course when prerequisites have not been satisfied;
- Waiving a required course;
- Dropping or adding a course after College or University deadlines;
- Requesting the pass/fail grade option;
- Ensuring that courses taken elsewhere will be counted toward degree requirements.

Follow these guidelines when completing the petition:

- Review the rules and policies of the College as published in the University of Colorado Catalog during your year of admission to this College and the current edition(s) of the appropriate Advising Guide to establish your need to petition and the specific rule or policy you wish to waive.
- Consult with the Undergraduate Advising Coordinator or your academic advisor or for clarification of departmental rules and policies.
- The petition must be clearly and neatly written with correct grammar and spelling, concise, and legible to all who must judge its merits. When referring to specific courses, the appropriate course number and title should be given. Be sure to include pertinent data such as a copy of the course syllabus.
- Submit your petition request to the Undergraduate Advising Coordinator for review and processing.

If properly completed, the petition process will normally take 2-4 weeks depending upon the submission date.

Once the petition has been submitted, you must keep in regular contact with the EVEN Undergraduate Advising Coordinator to be informed of the final decision and to sign the certification that he or she has been notified of the decision. Do not assume that departmental approval automatically assures College approval. Failure to confirm the final petition decision makes you responsible for any errors or problems which may result.

Note: Petition forms may be obtained from the Undergraduate Advising Coordinator.

4.9 Academic Honesty

The Environmental Engineering Program adheres to the College's policy on academic honesty, ethics and discipline, which states:

"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:

- Plagiarism;
- Cheating on examinations;
- Possession of or observation of examinations or solutions to examinations prior to the date and time of the exam;
- Any alteration, forgery, or falsification of official records;
- Performing work or taking an examination for another student; or
- Knowingly providing material of your own or of others to a fellow student."

The College's procedures for handling academic ethics violations is spelled out in the College of Engineering and Applied Science Advising Guide on this subject, which is available from the Dean's Office and in the lobby of the Engineering Center.

5 Faculty/Staff Directory

Environmental Engineering Program Faculty

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

Aerospace Engineering Sciences:

Judith A. Curry, Professor; Atmospheric Boundary Layer, Satellite and Aircraft Remote Sensing, Atmospheric Physics; B.S. 1974 Northern Illinois University (1974), Ph.D. University of Chicago (1982). curryja@cloud.colorado.edu, ECAE175.

William J. Emery, Professor; Satellite Remote Sensing of Oceans, Vegetation and Atmosphere; B.Sc.M.E. Brigham Young University (1971), Ph.D. Physical Oceanography, Univ. of Hawaii (1975). emery@frodo.colorado.edu, ECME275.

Jeffery Forbes, Professor; Atmospheric Fluid Dynamics; B.S. Electrical Engineering, University of Rhode Island (1968), M.S. Electrical Engineering, University of Illinois (1970), Ph.D. Applied Physics, Harvard University (1975). forbes@zeke.colorado.edu, ECAE177.

Chemical Engineering

David E. Clough, Professor; Control and Optimization, Water Resource Engineering and Management; B.S., Case Institute of Technology (1968), M.S., University of Colorado (1969), Ph.D. University of Colorado (1975). David.Clough@colorado.edu, ECCH112.

Robert H. Davis, Professor; Biotechnology, Fluid Mechanics, Membrane Separations with an emphasis on Environmental, Materials and Pharmaceutical Applications, Membrane Filtration and Microflotation for the Removal of Fine Particles and Oil Drops from Aqueous Streams; B.S. Chemical Engineering, University of California at Davis (1978), M.S. Chemical Engineering, Stanford (1979), Ph.D. Chemical Engineering, Stanford (1983). Robert.Davis@colorado.edu, ECCH108.

John L. Falconer, Professor; Heterogeneous Catalysis, Environmental Catalysis, Zeolite Membrane Separtions; B.E.S. Chemical Engineering, The Johns Hopkins University (1967), M.S. Chemical Engineering, Stanford University (1968), Ph.D. Chemical Engineering, Stanford University (1974); P.E. (Colorado). John.Falconer@colorado.edu, ECCH132.

William B. Krantz, Professor; Membrane Separations Technology for Gaseous and Liquid Systems, Development of Membranes for use in Hostile Environments, Detection and Remediation of Fouling in Membrane Separations for Liquid Solutes; B.A. Chemistry, Saint Joseph's College (Rensselaer)

(1961), B.S. Chem. Eng., University of Illinois (Urbana) (1962), Ph.D. Chem. Eng., University of California (Berkeley) (1968); P.E. (Colorado)

Dhinakar S. Kompala, Associate Professor; Biotechnology, Degradation of PCB's, Green (Environmentally conscious, i.e., minimizing waste by-product formation) Manufacturing of Fine Chemicals; B.Tech.Ch.E. Indian Institute of Technology, Madras (1979), M.S.Ch.E Purdue University (1982), Ph.D.Ch.E. Purdue University (1984). Dhinakar.Kompala@colorado.edu, ECCH114.

Richard D. Noble, Professor; Chemically Specific Separations, Zeolite Membranes, Catalytic Membrane Reactors, Separations Using External Fields, Facilitated Transport Membranes; B.E. Stevens Institute of Technology (1968), M.E. (Chemical) Stevens Institute of Technology (1969), Ph.D. University of California, Davis (1976); P.E. (Colorado). Nobler@colorado.edu, ECCH122.

W. Fred Ramirez, Professor; Process Simulation and Control ; B.S. Tulane University (1962), M.S. Tulane University (1964), Ph.D. Tulane University (1965). Fred.Ramirez@colorado.edu, ECCH126.

Paul Todd, Research Professor; Biochemical Separations, Gravitational Effects in Processes and Living Systems, Cell Growth and Regulation, Crystallization; B.A. Bowdoin College (1959), S.B. Massachusetts Institute of Technology (1959), M.S. University of Rochester (1960), Ph.D. University of California at Berkeley (1964). todd@spot.colorado.edu, ECCH124.

Civil, Environmental and Architectural Engineering:

Gary Amy, Professor; Potable Water Treatment and Water Chemistry; B.S., M.S. San Jose State University, Ph.D. University of California at Berkeley. gamy@spot.colorado.edu, ECOT513.

Angela Bielefeldt, Assistant Professor; Biological Treatment of Hazardous Organic Compounds, Subsurface Bioremediation, Biological Wastewater Treatment; B.S. Civil Engineering, Iowa State University (1992), M.S. Civil Engineering, University of Washington (1994), Ph.D. Civil Engineering, University of Washington (1996). bielefel@stripe.colorado.edu, ECOT516.

Steve Chapra, Professor; Water-Quality Modeling of Surface Waters, Transport and Fate of Pollutants in Natural Surface Waters; B.S. Civil Engineering, Manhattan College (1970), M.S. Environmental Engineering, Manhattan College (1972), Ph.D. Environmental and Water Resource Engineering; University of Michigan (1982). chapra@cadswes.colorado.edu, ECCE100.

James Heaney, Professor; Water Resource Systems and Water Resources Design; B.S. Illinois Institute of Technology, M.S., Ph.D. Northwestern University; P.E. heaney@spot.colorado.edu, ECCE108.

Mark Hernandez, Assistant Professor; Biological waste treatment processes, subsurface bioremediation, microbiology of aerosols; B.S., M.S., Ph.D. University of California at Berkeley. hernando@stripe.colorado.edu, ECOT518.

Diane McKnight, Associate Professor; B.S. Mechanical Engineering (1975), M.S. Civil Engineering (1978), Ph.D. Environmental Engineering (1979) Massachusetts Institute of Technology. Diane.McKnight@Colorado.EDU.

Russell Qualls, Assistant Professor; Surface and Atmospheric Hydrology, Evapotranspiration, Remote Sensing; B.A. Seattle Pacific University (1985), B.S.C.E University of Washington (1987), M.S. Cornell University (1991), Ph.D. Cornell University (1994). qualls@spot.colorado.edu, ECOT543.

Hari Rajaram, Assistant Professor; Groundwater and Contaminant Hydrology, Stochastic Modeling of Environmental Transport Processes; B.Tech. Indian Institute of Technology, Madras (1985), M.S.University of Iowa (1987), Sc.D. Massachusetts Institute of Technology (1991). hari@spot.colorado.edu, ECOT514.

Joseph N. Ryan, Assistant Professor; Contaminant Fate and Transport in Natural Waters, Surface and Colloid Chemistry; B.S. Geological Engineering, Princeton University (1983), M.S. Environmental Engineering, Massachusetts Institute of Technology (1988), Ph.D. Environmental Engineering, Massachusetts Institute of Technology (1992). joeryan@spot.colorado.edu, ECOT517.

JoAnn Silverstein, Associate Professor; Biological treatment of contaminants in water and wastes, water recycling, waste sludge management; BA Psychology, Stanford University (1967), BS Civil Engineering, University of California at Davis (1978), MS Civil Engineering, University of California at Davis (1980), PhD Civil engineering, University of California at Davis (1982), P.E. (Colorado). silverst@spot.colorado.edu, ECOT515.

Ken Strezepek, Associate Professor; Water and Environmental Systems, River Basin Management, Climate Change Impacts on Water Resources, Economic and Institutional Aspects of Water and Enviromental Management; Ph.D. Massachusetts Institute of Technology, P.E. (Texas). strzepek@spot.colorado.edu, ECOT549.

Jacquelyn F. Sullivan, Director, CADSWES (The Center for Advanced Decision Support for Water and Environmental Systems); Creation and leadership of successful software development teams for the application of advanced computer technologies to the resolution of water and environmental resources management problems; B.S. Biology, Olivet College (1972), M.S. Aquatic Toxicology, University of Detroit (1974), Ph.D. Environmental Health Physics and Environmental Toxicology, Purdue University (1977). sully@cadswes.colorado.edu, ITLL1B42.

Mechanical Engineering

Melvyn C. Branch, Professor; Combustion Generated Air Pollution, Hazardous Waste Destruction, Combustion Chemistry; B.S.E. Mechanical Engineering, Princeton University (1966), M.S. Mechanical Engineering, University of California at Berkeley (1968), Ph.D. Mechanical Engineering, University of California at Berkeley (1971). branch@spot.colorado.edu, ECAD132A.

John W. Daily, Professor; Hazardous Waste Destruction, Combustion, Propulsion, B.S.M.E. University of Michigan (1969), M.S.M.E. University of Michigan (1970), Ph.D. Mechanical Engineering, Stanford University (1975); P.E. (California). daily@spot.colorado.edu, ECME224.

Alan R. Greenberg, Professor; Development and Use of Thin Films and Membranes for Liquid and Gas Separations for Pollution Control; B.S. Metallurgical Engineering, Drexel University (1969), M.S. Environmental Engineering, Drexel University (1972), Ph.D. Biomedical/Materials Engineering, Drexel University (1978). greenbea@spot.colorado.edu, ECME277.

Jean R. Hertzberg, Associate Professor; Combustion Fluid Mechanics, Hazardous Waste Destruction; B.S.M.E. University of Michigan (1981), M.S. Mechanical Engineering, University of California at Berkeley (1983), Ph.D. Mechanical Engineering, University of California at Berkeley (1986). hertzberg@colororado.edu, ECME220.

Jana B. Milford, Associate Professor; Air Quality Modeling, Atmospheric Chemistry; B.S., Engineering Science, Iowa State University (1983), M.S., Civil Engineering, Carnegie Mellon University (1985), Ph.D. Engineering and Public Policy, Carnegie Mellon University (1988). milford@spot.colorado.edu, ECME222.

Shelly L. Miller, Assistant Professor; Indoor Air Quality, Bioaerosols; B.S., Applied Mathematics, Harvey Mudd (1986), M.S. Operations Research and Statistics, Claremont Graduate School (1987), M.S. Environmental Engineering, University of California at Berkeley (1991), M.S. Environmental Engineering, University of California at Berkeley (1996). shellym@stripe.colorado.edu, ECME226.