

DATE: January 18, 2008

TO: Vice Provost Randy Smith

FROM: Subcommittee B (Barringer, Caron, Robinson, Winer)

RE: Bachelor of Science in Environmental Engineering

Recommendation

Subcommittee B recommends approving this proposal.

Comments on this proposal

The college of Engineering would like to create a new degree program leading to the Bachelor of Science in Environmental Engineering. We requested and received a revised letter of concurrence from Chemistry and answers to additional questions raised by the committee. The other departments and colleges in the University who use the word "Environment" met on January 18 and did not have any concerns about the proposed major.



470 Hitchcock Hall
2070 Neil Ave
Columbus, OH 43210-1275

Phone (614) 292-2771
Fax (614) 292-3780

January 16, 2008

Sheryl Barringer, Professor and Graduate Studies Chair
Department of Food Science and Technology
The Ohio State University
317 Parker Food Science and Technology Building
2015 Fyffe Road, Columbus OH 43210-1007

Re: Request for supplemental information for BS Environmental Engineering proposal

Dear Professor Barringer,

Below please find our response to your request for follow-up information on our BS Environmental Engineering Proposal. Your questions are in bold and our response immediately follows:

We noticed the Gorman ranking (p35) is 9 years old. Has there been any more recent rankings?

The Gorman rankings have not been updated. While US News and World Report ranks undergraduate environmental/health programs, these rankings are not specific to environmental engineering programs. Also, most rankings focus on degree programs.

The student opinions (p15) are 5 and 7 years old. Have the students been polled since then?

We recently polled the students again regarding the new degree program. During Winter quarter, 2008, undergraduate students enrolled in CE620 were asked the following questions:

1. In general, do you think that a BS Environmental Engineering degree should be offered at OSU?
2. If a BS Environmental Engineering degree had been offered through CEEGS when you were a freshman, would you have enrolled in it rather than your current program?

As before, we found strong support for the new degree program. Of the 8 students polled, 100% indicated that a BS Environmental Engineering degree should be offered at OSU. Of the 8 students, 50% indicated that they would enroll in the new program if it was available. These results are comparable to results obtained in 2002 which showed that

again 100% of the students supported the degree and 59% would have taken the degree if it had been available.

After making the changes requested by Chemistry, did you send the proposal to them again for final approval? We need a revised letter of concurrence from them stating whether or not they are in favor of this revised proposal.

The department of Chemistry has reviewed the revised proposal and now supports the new degree. A letter of concurrence is enclosed.

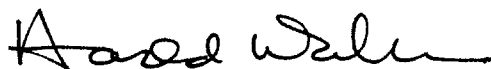
Does this proposal use the old GEC and credit hour requirements? If it does, how do you plan to change the requirements to meet the new requirements of your college?

I believe Ed McCaul has addressed the issue of the GECs in a previous communication. His response is reproduced below.

RESPONSE: The overall GEC hours will be reduced from 40 to 35, and the overall hours from 198 to 193. The new College of Engineering guidelines will be used for the GECs: 10 hours in English and Communication Skills:(English 110 and a 2nd writing course); 25 hours across Social Sciences, Historical Study, and Arts & Humanities with a minimum of 5 hours and maximum of 10 hours per category.

I hope we have addressed all of your questions. Please contact me if you have any additional questions or concerns regarding this proposal. I can be reached at 614-292-8263 or by email at walker.455@osu.edu.

Sincerely,



Harold W. Walker, Ph.D., P.E.
Associate Professor



Christopher M. Hadad

(614) 688-3141 (voice)

(614) 292-1685 (fax)

hadad.1@osu.edu

Department of Chemistry

Newman and Wolfrom Laboratory

100 West 18th Avenue

Columbus, OH 43210-1185

www.chemistry.ohio-state.edu

January 16, 2008

Harold W. Walker, Ph.D., P.E.

Associate Professor

Department of Civil and Environmental Engineering and Geodetic Science

The Ohio State University

470 Hitchcock Hall, 2070 Neil Avenue

Columbus, OH 43210

Dear Hal,

My staff and I have looked over your proposed BS degree in Environmental Engineering.

We are delighted to offer concurrence on your revised proposal. Your changes to include Chemistry 221 and 587 for analytical training is excellent, and we can provide that service to your students.

I hope that this succinct letter will function as concurrence from Chemistry.

Please let me know if you need any further information.

Sincerely,

Christopher M. Hadad

Professor of Chemistry and Vice Chair for Undergraduate Studies



College of Engineering

122 Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210-1278

Phone 614-292-2651
FAX 614-292-9379
E-mail engosu@osu.edu

Date: 29 May 2007

To: Randy Smith
Vice Provost, Office of Academic Affairs

From: Ed McCaul
Secretary College of Engineering Committee on Academy Affairs

Subject: BS Degree in Environmental Engineering

Attached is a copy of the Department of Civil and Environmental Engineering and Geodetic Science's proposed BS Degree in Environmental Engineering. The College's Committee on Academic Affairs unanimously approved this proposal on the 23rd of May 2007. If you have any questions concerning this proposal please let me know.

PROPOSAL FOR A

BACHELOR OF SCIENCE DEGREE IN

ENVIRONMENTAL ENGINEERING (BSE_{envE})

by

The Ohio State University

College of Engineering

Department of Civil and Environmental Engineering and Geodetic Science

Environmental Engineering Undergraduate Studies Committee (ABET)

Prof. Robert M. Sykes, Ph. D., P. E., Committee Chair, *

Prof. Keith W. Bedford, Ph. D. (Emeritus)

Assoc. Prof. E. Earl Whitlatch, Ph. D.

Assoc. Prof. Harold W. Walker, Ph. D., P. E.

Assoc. Prof. Linda K. Weavers, Ph. D., P. E.

Assist. Prof. Diane Foster, Ph. D.

Assist. Prof. John Lenhart, Ph. D.

January 1, 2007

* contact person: sykes.1@osu.edu; (614) 292-2478; 417A Hitchcock Hall, 2070 Neil Ave, Columbus, OH 43210.

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Executive Summary

First, this proposal does not request the establishment of a new academic program. Rather it proposes the relabelling and restructuring of an existing program, the ABET-accredited Environmental Engineering Option in Civil Engineering, to bring it into closer conformity with the practices of other ABET-accredited programs in Environmental Engineering.

Second, this is a zero-cost proposal. All the required faculty, laboratories, courses, etc., are already in place.

Third, in addition to the Environmental Engineering program described herein, the environmental engineering faculty have many responsibilities to the Civil Engineering program, and in fact they teach one-eighth of all the student credit hours earned by the Department of Civil and Environmental Engineering and Geodetic Science, including the student credit hours generated by our Engineering Graphics program.

A short history of the ABET-accredited Environmental Engineering Option in Civil Engineering is presented in Appendix A on page 67. An environmental engineering program of one sort or another has existed at Ohio State ever since the Department of Civil Engineering was established in the early 1870's. However, the Option was first accredited separately from Civil Engineering only in 1993; it has been reaccredited separately and continuously ever since.

The current Environmental Engineering Option in Civil Engineering differs from its sister programs at other institutions in two ways. First, of the 47 ABET-accredited programs, it is the only program to grant its graduates a Bachelor of Science in Civil Engineering; all other Environmental Engineering programs grant their graduates a Bachelor of Science in Environmental Engineering or a degree that is similarly named.

Second, of the 47 ABET-accredited programs, it is the only program to require its majors to take the traditional civil engineering core curriculum, which includes courses in structural analysis and design, transportation planning, construction management, surveying and soil mechanics. These courses are not taken by environmental engineering majors attending our sister institutions. The proposed curriculum revision will put Ohio State University in conformity with the standard practices of other ABET-accredited environmental engineering programs.

1. Reasons for a Bachelor of Science in Environmental Engineering

We propose to change the current Environmental Engineering Option in Civil Engineering (accredited by ABET) that leads to the Bachelor of Science in Civil Engineering (BSCE) degree to a Bachelor of Science in Environmental Engineering (BSEnE). This change is proposed for four reasons:

1. It conforms to the current practice of the profession whereby ABET-accredited baccalaureate programs in Environmental Engineering lead to the BSEnE degree.
2. It brings the program into conformance with the recent changes in ABET criteria for accreditation and to the content of the National Council of Engineering Examiners for Engineering and Surveying (NCEES) examinations for licensing as a professional engineer in Environmental Engineering. (See page 28.)
3. It allows upgrading of OSU's existing MS/PhD graduate programs in Environmental Engineering by replacing coursework relevant to Civil Engineering with course work relevant to Environmental Engineering. (See page 29 and 70.)
4. It improves the visibility of the program and enhances recruitment on campus, in Ohio and nationwide. (See page 29.)

With respect to this last reason. It should be noted that the University, College and Department of Civil and Environmental Engineering and Geodetic Science only advertise programs that lead to a degree. As a consequence, all references to the Environmental Engineering Option are buried deeply within the various University, College and Department brochures and websites.

A sequence of technical electives that focuses on the water, wastewater and solid wastes components of environmental engineering will continue to be offered within the Civil Engineering program to serve the traditional needs of civil engineering majors. This elective sequence will not meet ABET requirements for accreditation as an environmental engineering program, although it will contribute to maintaining accreditation of the existing Civil Engineering program.

An Environmental Engineering Minor is currently available for those students who wish an introduction to environmental engineering. This Minor also does not meet ABET accreditation requirements for environmental engineering programs.

2. Main Changes in the Environmental Engineering Option in Civil Engineering

The main changes in the Environmental Engineering Option in Civil Engineering are: (1) the deletion of those courses that are directly concerned with the design and construction of civil

engineering infrastructure but that are not relevant to environmental engineering accreditation, practice and licensure; and (2) the addition of other courses that are relevant to environmental engineering accreditation, practice and licensure.

The deletions are (41 cr. hr.):

CE 400	Introduction to Geomatics	4	cr. hr.
CE 431	Structural Engineering Principles	3	cr. hr.
CE 451	Civil Engineering Materials	4	cr. hr.
CE 535	Basic Reinforced Concrete Design	5	cr. hr.
CE 554	Geotechnical Engineering	4	cr. hr.
CE 570	Transportation Engineering and Analysis.	4	cr. hr.
CHEM 122	General Chemistry	5	cr. hr.
ECE 300	Electrical Circuits	3	cr. hr.
MATH 255	Differential Equations and their Applications	5	cr. hr.
ME 500	Engineering Thermal Sciences	4	cr. hr.

The additions are (41 cr. hr.):

ChBE 771	Air Pollution	3	cr. hr.
CHEM 125	Chemistry for Engineers	4	cr. hr.
CHEM 221	Analytical Chemistry I	5	cr. hr.
CHEM 231	Introduction to Organic Chemistry	3	cr. hr.
CHEM 520	Physical Chemistry	3	cr. hr.
CHEM 521	Physical Chemistry	3	cr. hr.
CHEM 587	Analytical Chemistry II: Instrumental Analysis	3	cr. hr.
MATH 415	Ordinary and Partial Differential Equations	4	cr. hr.
Soil Sci. 300	Soil Science	5	cr. hr.
	Additional Technical Electives	8	cr. hr.

Note: As a consequence of the recent ABET review, the Environmental Engineering Option in Civil Engineers has no electives other than GEC. The conversion of this program to a BSEnE degree will allow the students at least three technical electives.

These changes will bring OSU's program into closer agreement with other Environmental Engineering programs. The following items are relevant to our proposed course changes.

1. The proposed BSEnE curriculum will contain more chemistry than is typical of other accredited programs, specifically a course in analytical chemistry and a second course in physical chemistry.
2. Twenty five of the accredited programs require mechanical engineering thermodynamics and 10 require chemical thermodynamics. Five programs require no thermodynamics. OSU's proposed curriculum will require chemical thermodynamics.
3. Only 10 programs require electrical circuits.

4. Only 16 programs require geotechnical engineering (soil mechanics). The proposed curriculum will require a course in soil science that covers soil properties and chemistry rather than mechanics.
5. Only seven programs require geomatics (mostly geographic information systems).
6. Only two programs require structural analysis and reinforced concrete design.
7. No program requires transportation engineering.

Statement of Support by Department Chair

6 February 2006

Dean William A. Baeslack, III
College of Engineering
The Ohio State University
142 Hitchcock Hall, 2070 Neil Avenue
CAMPUS

Dear Dean Baeslack:

I am pleased to present you with a copy of a proposal by the Faculty of the Department of Civil and Environmental Engineering and Geodetic Science (CEEGS) to convert our present ABET-accredited Environmental Engineering Option in Civil Engineering, which leads to a BSCE degree, to a stand-alone Bachelor of Science in Environmental Engineering, which would lead to a BSEnE degree.

This proposal brings Ohio State into conformance with other accredited undergraduate environmental engineering programs in the U.S.; gives us the flexibility to adapt to the evolving standards for program accreditation and practitioner licensing; and greatly enhances the local, state and national visibility of our program. The latter should facilitate and improve recruitment.

CEEGS currently has nine full-time or part-time faculty involved at both the undergraduate and graduate levels of our Environmental Engineering Option program. These faculty have extensive professional and personal ties with numerous faculty in other departments of the College of Engineering and with the Colleges of Mathematics and Physical Sciences, Biological Sciences, and Food, Agriculture and Environmental Science. Many of these faculty were hired as part of OSU's several academic enrichment programs. They have formal relationships with the other departments that participated in these successful proposals. Nearly all are members of the interdisciplinary Environmental Sciences Graduate Program.

Over the last decade, CEEGS and COE have made substantial investments in laboratory and space facilities to support our environmental engineering program. It is an area of our department that has strong research funding and job opportunities for both graduate and undergraduate students. The enclosed proposal will do much to enhance these relationships and investments. I urge your support and approval of the proposal.

I should be most happy to meet with you at your convenience to discuss this proposal and answer any questions you might have.

Sincerely,



Carolyn J. Merry
Professor and Chair

Vote of Department Faculty

On Friday, January 13, 2006, the faculty of the Department of Civil and Environmental Engineering and Geodetic Science met and approved this proposal to convert the existing ABET-accredited Environmental Engineering Option in Civil Engineering (which leads to the BSCE) to a stand-alone ABET-accredited Bachelor of Science in Environmental Engineering (BSEnE) by a vote of 17 yes, 0 no, and 0 abstentions. At the time of the vote, the Department had 25 faculty, including Chair Merry.

Statements of Support by Students and Description of Student Involvement in Committee Planning Process

Students enrolled in Environmental Engineering courses were surveyed twice, once during Spring Quarter 2000 and once during Summer Quarter 2002.¹ In general, the surveys indicate very strong support for the existence of a BSEnE degree program and substantial interest in obtaining such a degree. Furthermore, the ABET-accredited Environmental Engineering Option in Civil Engineering is not advertised in either the University's or the College of Engineering's recruiting literature, and all these students had enrolled in either Civil Engineering or Chemical Engineering as their first choice. Nearly all of them came to take environmental engineering electives after discovering the existence of such courses either by themselves or with the aid of a knowledgeable departmental advisor. It is believed that a BSEnE degree program would result in the recruitment of more students to OSU.

During Spring Quarter 2002, all students enrolled in CE 717 and CE 722 were asked the following questions:

1. In general, do you think that a BS Environmental Engineering degree should be offered at OSU?
2. If a BS Environmental Engineering degree had been offered through CEEGS when you were a Freshman, would you have enrolled in it rather than your current program?

All 17 students queried stated that a BSEnE degree should be offered at OSU; 10 students stated that they would have taken the BSEnE rather than a BSCE or BSChE degree. Twelve of the students were enrolled in the BSCE degree program; all of them supported the existence of the BSEnE; and eight of them would have enrolled in the BSEnE if it had existed. Five of the students were enrolled in the BSChE degree program, and two of them would have preferred a BSEnE degree. It should be noted that seven of the Civil Engineering students and all of the Chemical Engineering students in these courses had already chosen to pursue environmental engineering electives within their majors.

1. The survey forms are on file in the office of the Chairperson of the Environmental Engineering Undergraduate Studies Committee and are available upon request.

Students taking the Environmental Engineering Option in Civil Engineering were asked the following question by email during the Summer Quarter 2002: Would you rather

1. take a BS degree program in Civil Engineering, or
2. take a BS degree program in Environmental Engineering?

Of the 37 students queried, 12 replied. Eight of the students would prefer to take a BSEnE degree program, and three would prefer a BSCE degree program. One student was interested in the BSEnE but wanted further information before deciding.

Letters of Concurrence from Other Programs at The Ohio State University and from Employers of Our Graduates

The following departments and schools were queried regarding their support for or objection to the establishment of a BS in Environmental Engineering:

1. Department of Chemical and Biochemical Engineering;
2. Department of Chemistry;
3. Department of Food, Agriculture and Biological Engineering;
4. Department of Mechanical Engineering;
5. School of Earth Sciences (formerly Department of Geological Sciences);
6. School of Environmental and Natural Resources (formerly School of Natural Resources); and
7. School of Public Health.

Each department Chair received a copy of this proposal along with the query. The responses follow on the next few pages.

It should be noted that all seven of the Departments and Schools support the proposal.

The Department of Chemistry recommended that we increase the amount of chemistry in the proposed curriculum, and we have done so. The School of the Environment and Natural Resources and the Department of Food, Agricultural and Biological Engineering suggested additional technical elective courses, and these suggestions have also been adopted.

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the ²³
Department of Civil and Environmental Engineering and Geodetic Science

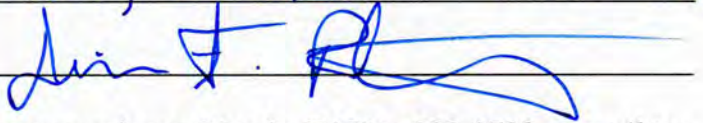
Date: 4/12/06

Responding Department/Program/Unit: Chemical & Biomolecular Engineering

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

James F. Rathman
Responding Unit Representative (please print)
Title: Professor, ~~Faculty~~ Curriculum Committee Chair
Signature: 

Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

Prof. Robert M. Sykes, Ph. D., P. E.
Chair, Environmental Engineering Undergraduate Studies Committee
Department of Civil and Environmental Engineering and Geodetic Science
470 Hitchcock Hall
2070 Neil Ave
CAMPUS

292-2748; sykes.1@osu.edu

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

Date: June 13, 2006

Responding

Department/Program/Unit: CHEMISTRY

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

The Undergraduate Curriculum Committee of the Chemistry Department has reviewed the proposal to establish a BS degree in Environmental Engineering. While on the whole supportive of the proposal, our committee would like to recommend the following changes in the Chemistry requirements for the degree, which in our version of the proposal stand as Chem 121 and Chem 125 under College Requirements, and Chem 231, Chem 520 and Chem 521 under Professional Courses.

Under Professional Courses, we recommend requiring students to take at least 4 of the following courses: Chem 221, Chem 231 or 251, Chem 252, Chem 520 and 521. Note that the Department of Chemistry would be willing to waive the Chem 221 prerequisite of Chem 123 for students in the BSENE program because of their superior backgrounds math and physics.

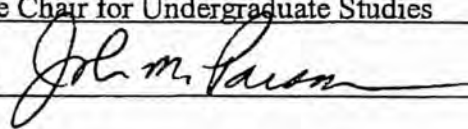
Under Electives, we recommend including Chem 587 and 588.

We feel that this would allow more weight to analytical chemistry (Chem 221, 587, 588) and organic chemistry (Chem 251, 252) than in the original proposal, which does not adequately emphasize the core roles these areas play in environmental sciences.

John M. Parson

Responding Unit Representative (please print)

Title: Vice Chair for Undergraduate Studies

Signature: 

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

25

Date: April 14, 2006

Responding Department/Program/Unit: Food, Agricultural, and Biological Engineering

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

Thank you for including FABE 652 among your pre-approved technical electives. We would recommend that you consider also including FABE 650 "Design of Waste Management Systems" which covers small, decentralized, and rural wastewater and waste management systems.

Thomas L. Bean
Responding Unit Representative (please print)

Title: Professor and Chair

Signature: *Thomas L. Bean*

Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

Prof. Robert M. Sykes, Ph. D., P. E.
Chair, Environmental Engineering Undergraduate Studies Committee
Department of Civil and Environmental Engineering and Geodetic Science
470 Hitchcock Hall
2070 Neil Ave
CAMPUS

292-2748; sykes.1@osu.edu

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET) 26
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

Date: May 15, 2006

Responding Department/Program/Unit: Mechanical Engineering

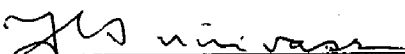
Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

K. Srinivasan
Responding Unit Representative (please print)

Title: Professor and Chairperson

Signature: 

Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

Prof. Robert M. Sykes, Ph. D., P. E.
Chair, Environmental Engineering Undergraduate Studies Committee
Department of Civil and Environmental Engineering and Geodetic Science
470 Hitchcock Hall
2070 Neil Ave
CAMPUS

292-2748; sykes.1@osu.edu

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

Date: March 1/06

Responding School/Department/Program/Unit: Geological Sciences

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

FRANK SCHWARTZ
Responding Unit Representative (please print)

Title: CHAIR GEOLOGICAL SCIENCES

Signature: Frank W. Schwarz

Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

Prof. Robert M. Sykes, Ph. D., P. E.
Chair, Environmental Engineering Undergraduate Studies Committee
Department of Civil and Environmental Engineering and Geodetic Science
470 Hitchcock Hall
2070 Neil Ave
CAMPUS

292-2748; sykes.1@osu.edu

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

Date: _____

Responding School/Department/Program/Unit: Environment and Natural Resources

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

NEIL J. ANDREW, CHAIRMAN

Responding Unit Representative (please print)

(SENR) Title: ACADEMIC AFFAIRS COMMITTEE

Signature: Neil J. Andrew

Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

Prof. Robert M. Sykes, Ph. D., P. E.
Chair, Environmental Engineering Undergraduate Studies Committee
Department of Civil and Environmental Engineering and Geodetic Science
470 Hitchcock Hall
2070 Neil Ave
CAMPUS

292-2748; sykes.1@osu.edu

CONCURRENCE FORM
FOR
BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (ABET)
offered by the
Department of Civil and Environmental Engineering and Geodetic Science

29

Date: 4/3/06

Responding Department/Program/Unit: School of Public Health

Please check as appropriate:

- Our Department/Program /Unit is pleased to support the proposed Bachelor of Science in Environmental Engineering (BSEnE).
- Our Department/Program/Unit has no opinion regarding the proposed BSEnE.
- Our Department/Program/Unit is either opposed to or has reservations regarding the proposed BSEnE.

Comments (use additional sheets as needed):

Stanley Lemeshow
Responding Unit Representative (please print)
Title: Dean, School of Public Health, OSU
Signature: Stanley Lemeshow

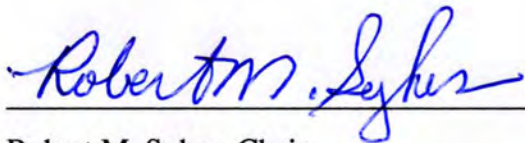
Please return this form or a letter of concurrence/opposition by FAX to 292-3780, or mail to:

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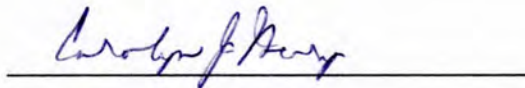
Statement of No New Financial Requirements³⁰

The implementation of the proposed Bachelor of Science in Environmental Engineering (BSEnE) does not entail any additional faculty, facilities or money. It is an evolutionary conversion of the existing Environmental Engineering Option in Civil Engineering, which has been in existence in one form or another since 1972, and which leads to the BSCE degree.



Robert M. Sykes, Chair,
Environmental Engineering Undergraduate
Studies Committee
Dept. Civil & Environ. Eng'g and Geod. Sci.

4/3/06
Date



Carolyn J. Merry, Chair,
Dept. Civil & Environ. Eng'g and Geod. Sci.

3 April 06
Date

PART A

I. General Information

1. Nature of Proposal

This is a proposal for a new baccalaureate degree program. It is an evolutionary development of the existing Environmental Engineering Option in Civil Engineering. The Option is currently accredited by ABET,² which is the principal accreditation body for engineering and technology programs in the United States.

2. Name of Program

Environmental Engineering.

3. Degree Title

Bachelor of Science in Environmental Engineering (BSEnE).

4. Implementation Date

The Bachelor of Science in Environmental Engineering will be implemented as soon as approval is granted. It will replace the existing ABET-accredited Environmental Engineering Option in Civil Engineering, which will be discontinued.

A sequence of technical electives that focuses on the water, wastewater and solids wastes components of environmental engineering will continue to be offered within the Civil Engineering program to serve the traditional needs of civil engineering majors. This elective sequence will not meet ABET requirements for accreditation as an environmental engineering program, although it will contribute to maintaining accreditation of the Civil Engineering program.

2. Formerly, the Accreditation Board for Engineering and Technology.

An Environmental Engineering Minor is currently available for those students who wish a broader introduction to environmental engineering than is provided by the technical elective sequence in Civil Engineering. This Minor also does not meet ABET accreditation requirements for environmental engineering programs.

5. Transitional Policy

Students currently enrolled in the Environmental Engineering Option in Civil Engineering will continue in that program and receive the BSCE. Students enrolled in that program who wish to receive the BSEnE will be allowed to count up to 16 credit hours in the civil engineering core as technical electives. Unless specifically allowed, Civil Engineering core courses³ that also count as Environmental Engineering core courses may not be counted as technical electives.⁴ CE 554 Geotechnical Engineering (which is in the Civil Engineering core) is allowed as an Environmental Engineering technical elective.

6. Administrative Unit

The Bachelor of Science in Environmental Engineering will be administered by the Department of Civil and Environmental Engineering and Geodetic Science in the College of Engineering.

II. Rationale, Goals and Objectives

1. Rationale and Purpose

The degree “Bachelor of Science in Environmental Engineering,” which we propose to introduce at The Ohio State University, is now the standard degree awarded to students of undergraduate environmental engineering programs in the United States.

3. These are CE 431, 451, 570, and 535.

4. These are CE 405, 406, 413, 460, 516, 520, 540 and 576,

This change is required by the rapid evolution of the content of environmental engineering. As recently as 1990, both our academic accrediting body (ABET) and our professional licensing body (National Council of Examiners for Engineering and Surveying, NCEES) used the civil-sanitary engineering model to define environmental engineering. In that model, an environmental engineer is a civil engineer with additional training in water quality, water supply, wastewater disposal and solid waste management. Such topics fit easily into standard civil engineering degree programs, and the programs could be accredited as Environmental Engineering programs, as ours was. Graduates (holding the Bachelor of Science in *Civil Engineering*) were qualified to sit for either the civil engineering and/or the environmental engineering professional engineers examination. This has been the situation at The Ohio State University since 1993.

During the 1990s, at the request of industry groups and federal departments, the definition of environmental engineering used by ABET and NCEES was broadened to include air pollution, occupational health and safety, radiological health and risk management. A typical undergraduate program now must include topics in air, land and water pollution and environmental health, *viz.*:⁵

1. hydraulics and hydrology;
2. water and wastewater treatment;
3. environmental chemistry;
4. water quality modeling of lakes, estuaries and rivers
5. air pollution effects and meteorology;
6. air pollution abatement technologies;
7. occupational and environmental health and safety;
8. solid waste management;
9. hazardous and radioactive waste management;
10. pollution prevention, including recycling and “green” manufacturing;
11. risk assessment and management

5. See Section 1. Required Courses on page 44 and Appendix B on page 70

Such a program no longer fits within the credit hour limitation of a civil engineering program because of the need to cover traditional and core civil engineering topics like structural design and analysis, construction management, geomatics, geotechnology and transportation engineering.⁶ In the case of the Environmental Engineering Option in Civil Engineering here at OSU, all 27 technical elective hours are specified, and our students have no free or technical electives. By comparison, the other civil engineering options in our BSCE program only specify about 12 to 16 of the required 27 technical credit hours. A survey of ABET-accredited environmental engineering curricula shows that virtually all such programs have dropped courses in structural analysis and design, construction management, geotechnical engineering and transportation planning. All these programs now award the Bachelor of Science of Environmental Engineering or a similarly named degree.

This change will also benefit our environmental engineering graduate program. For historical reasons, American MS/PhD environmental engineering programs have enrolled mostly holders of BSCE degrees. Of necessity, a portion of their graduate education is devoted to remediating deficiencies in chemistry, biology and other topics important to environmental engineering but not included in undergraduate Civil Engineering programs. However, with the adoption of a BSEnE degree program, the remedial aspects of our graduate programs can be eliminated, and we will be able to enhance the engineering, scientific and management skills of our MS and PhD students.

Finally, a separate BSEnE degree will enhance the program's visibility, both on-campus and nationwide, and it will increase the number of students enrolled in the program. This is a consequence of how the University, College and Department present information to potential students. The current University, College of Engineering and Department of Civil and Environmental Engineering and Geodetic Science web pages are organized by degree titles instead of academic programs and do not directly index "Environmental Engineering." On the OSU website, one has to go to the section entitled "Civil and Environmental Engineering and Geodetic Science" or use a search engine to find information about environmental engineering. The OSU Course Offerings Bulletin makes no reference to "Environmental Engineering." However, it does reference "Environmental Science", which is a different program in the School of Environment and Natural Resources.

6. See Appendix D on page 81 for a history of the changes in ABET requirements for the Environmental Engineering Option.

2. Educational Goals and Objectives

The Mission of the Environmental Engineering Option in Civil Engineering was developed by the Environmental Engineering faculty based on the University, College and Department Mission and Vision Statements along with programmatic considerations.

The Environmental Engineering Program's Mission is:

To educate professionals in Environmental Engineering, to create and disseminate knowledge and technology, and to provide innovative solutions to societal problems through comprehensive Environmental Engineering education and innovative research, teaching and public service.

The Environmental Engineering Program's Objectives are:⁷

1. environmental engineering graduates will demonstrate a strong ability to apply analytical tools (mathematical and computational), basic sciences, and engineering sciences in engineering practice;
2. environmental engineering graduates will demonstrate a strong ability to design a system, component, or process to meet desired needs within realistic constraints;
3. environmental engineering graduates will be active professionally and engage in life-long learning; a large percentage will become licensed professional environmental engineers;
4. environmental engineering students will demonstrate effective communication skills, both oral and written, individually and as team members;
5. environmental engineering graduates will demonstrate knowledge of contemporary issues, including the need for a diverse workforce, and an understanding of the impact of engineering solutions in a global, economic, environmental, and social context; professional and ethical responsibility will guide their engineering career.

7. These Program Objectives are published in *The Ohio State University Bulletin: College of Engineering Book 9*, which is given to incoming freshmen during orientation.

3. Relationship to University, College and Department Goals and Objectives

The Program Objectives are consistent with the research, teaching, and public service missions of The Ohio State University, College of Engineering, and Department of Civil and Environmental Engineering and Geodetic Science.

University. The Ohio State University is the land-grant university of the State of Ohio. Faculty are expected to be active researchers, competent teachers, and providers of outreach services to the public. The first, second and third Program Objectives⁸ address the research function by focusing on analytical tools and the basic engineering sciences necessary to pursue graduate education, and by motivating students to continue their education. The first, second and third Objectives⁹ aim at outstanding teaching that will help students to become professional engineers equipped for modern engineering practice. The fifth objective emphasizes the public service role of faculty and students.

The proposed BSEnE degree supports the University's efforts to promote interdisciplinary studies. Three of our faculty were hired through the University's Academic Enrichment program: Dr. Linda Weavers¹⁰, Dr. Timothy Granata¹¹ and Dr. John Lenhart¹².

The University is committed to building Ohio's future. Environmental engineering itself is an important factor in the ongoing development of Ohio's industrial and agricultural bases. Both industry and agriculture generate a variety of wastes that can impair the air, water and soil of Ohio and the health and well-being of its citizens and wildlife. There are 30 Superfund Sites in Ohio.¹³ The Ohio Environmental Protection Agency currently monitors the air in 49 urban, suburban and rural sites for carbon monoxide, ozone, sulfur dioxide and particulates, and it does detailed biological and chemical surveys of about six rivers per year. Industry and agriculture also depend for

8. See page 30.

9. See page 30.

10. In conjunction with hires in the Departments of Chemical and Biomolecular Engineering and of Public Health to develop a program in hazardous waste management.

11. In conjunction with hires in the Department of Food, Agriculture and Biological Engineering and the School of Natural Resources to develop a new Ecological Engineering program. Dr. Granata has left the University and a search for his replacement is currently underway.

12. In conjunction with the Departments of Chemistry, Chemical and Biomolecular Engineering, Geological Sciences and the School of Natural Resources to enhance their programs in surface chemistry.

13. <http://www.epa.gov/superfund/sites/npl/oh.htm#statelist>

their success upon clean, healthy environments. Environmental engineering provides the knowledge and tools and the educated professionals to both mitigate waste discharges and to protect the environment of economically productive entities.

The Ohio State's Environmental Engineering Option in Civil Engineering already contributes to the University's goal of a diverse faculty, staff and student body. Two of its six faculty are women; this is twice the national average of 15% women faculty in environmental engineering programs and four times the national average for all engineering disciplines. Environmental engineering programs generally attract more women and minority undergraduates than most other engineering disciplines. Nationally, about 40% of students enrolled in BSEnE programs are women, 3% are African-American, 3% Hispanic and 2% are Native American.¹⁴ The increased visibility of a BSEnE degree program would enhance our ability to continue to do so.

College. The proposed BSEnE directly supports the College of Engineering's initiative in Energy and Environmental Quality. This is one of three areas selected by the College for increased funding and support.

The enhanced visibility accruing to the BSEnE will also support the College's goals for improved student recruiting and profession recognition and, *via* the Environmental Engineering Advisory Committee, its outreach goal.

Department. The proposed BSEnE directly supports the Department's area of excellence in environmental engineering systems. It also supports the Department's strategy to enhance its public ranking.

4. Unique Characteristics and Appropriateness

Ohio is a populous state with many large urban areas and numerous heavy manufacturing and large-scale agribusiness facilities. These areas and facilities generate large amounts of waste that could potentially pollute Ohio's air, soil and water, seriously affecting the health and welfare of Ohio's citizens and their natural environment. In fact, some pollution does occur despite our heavy investment in pollution abatement facilities and "green" operations. Research, teaching and

14. *AEESP Newsletter*, September, 2006.

public service to mitigate environmental pollution are obligatory and defining activities for a land-grant institution like The Ohio State University.

The proposed ABET-accredited BS Environmental Engineering degree program would be the only such program in Ohio. It would strongly support one of the major goals of both the University and the College of Engineering—support of environmental science and engineering research, teaching and service. Also, the current environmental engineering faculty offer a number of courses¹⁵ that complement and reinforce the undergraduate and graduate programs of several other departments, including:

1. Chemical and Biomolecular Engineering,
2. the environmental and surface chemistry programs in Chemistry,
3. the biological engineering program in Food, Agriculture and Biological Engineering,
4. the landscape architecture program in the Knowlton School of Architecture,
5. the nuclear engineering program in Mechanical Engineering,
6. the hydrogeology program in the School of Earth Sciences,
7. the environmental science and soil science programs in the School of Environment and Natural Resources, and
8. the environmental health sciences program in the School of Public Health.

Some students enrolled in BS and MS programs in CBE, FABE, SES and SENR already take one or more of the courses offered by CEEGS faculty, and the recently developed Minor in Environmental Engineering is beginning to prove popular, and is starting to attract students from outside the College of Engineering. The enhanced visibility of a BS EnvE degree program, especially its inclusion in the University's web sites and Course Offerings Bulletin, will increase the number of nonengineering students taking Environmental Engineering courses, and because of the synergisms between it and other College BS programs might attract nonengineering students to other courses in the COE.

15. Specifically: CE 511 Introduction to Environmental Engineering, CE 520 Treatment Plant Design, CE 610 Analysis of Natural and Polluted Waters, CE 613 Applied Hydrology, CE 618 Ecological Engineering and Science, CE 624 Coastal and Ocean Engineering, CE 711 Biological Processes for Used Water Treatment, CE 714 Hazardous Waster Management, CE 717 Municipal and Industrial Solid Waste Management, CE 719 Water Quality Modeling, CE 720 Environmental Engineering Risk Assessment, CE 722 River and Open Channel Hydraulics and CE 723 Transport Phenomena in Water Resources Engineering.

Because it is the state capital and a major city, many national/ international and regional environmental engineering firms maintain offices in Columbus.¹⁶ A strong BSEnE program would better serve the professional interests of these companies and provide more avenues of fruitful cooperation in research and education. The State of Ohio now demands proof of continuing education credits for renewing engineering licenses, and the COE should play a major role in the process.

5. Benefits to Students, The Ohio State University and the State of Ohio

Graduates from the proposed BSEnE degree program would benefit by better professional preparation, both for employment as practicing engineers and as graduate students. Because of their historical ties to civil engineering and the consequent need to take course work in traditional civil engineering topics, in the past undergraduate environmental engineering programs did not provide a broad enough base in environmental engineering. Consequently, environmental engineering students have had to go on to graduate school to get the needed environmental course work. With the proposed BSEnE program, graduates will have the previously missing training and will be more productive employees and graduate students. This will benefit the students, their employers and graduate schools.

6. Similar Academic Programs in Public and Independent Institutions

There are currently 47 ABET-accredited undergraduate environmental engineering programs in the United States, which is an increase of nine since 2002. Forty one (41) of these programs award successful candidates a Bachelor of Science in Environmental Engineering. One programs, our own, continues to offer a Bachelor of Science in Civil Engineering. Thirty five (35)

16. Specifically: A&S Enterprise; ATC Associates; BBS Corp.; Bennett & Williams Environmental Consultants, Inc.; BHE Environmental Inc.; Bennett & Williams Environmental Consultants, Inc.; Brown and Caldwell; Burgess & Niple, Ltd.; Camp, Dresser & McKee; Civil & Environmental Consultants, Inc.; DLZ Ohio; EMH&T; Fuller Mossbarger Scott & May Engrs., Inc.; Gandee and Associates; Geotechnical Consultants, Inc.; Gannett Fleming Engineers and Architects; Malcolm Pirnie, Inc.; Metcalf & Eddy; M-E Engineering; MS Consultants, Inc.; Pandey Environmental LLC; Parsons Brinkerhoff-Ohio; Parsons Transportation Services; RMT, Inc.; Safex; Sharp & Associates; Spence Environmental Consulting; Stone Environmental Engineering and Science, Inc.; URS Corp.; Zande R&D Associates

of the environmental engineering programs, including OSU's, are administered by the same department that administers the civil engineering program.

In 1998, the current Environmental Engineering Option in Civil Engineering was ranked sixth (6) out of the then 32 ABET-accredited undergraduate Environmental Engineering programs. The top eleven schools were listed as:¹⁷

1. Rensselaer Polytechnic Institute, Troy, New York
2. Massachusetts Institute of Technology, Cambridge, Massachusetts
3. Northwestern University, Evanston, Illinois
4. University of Florida, Gainesville, Florida
5. University of Michigan, Ann Arbor, Michigan
6. The Ohio State University, Columbus, Ohio
7. Michigan Technological University, Houghton, Michigan
8. Montana Tech of the University of Montana
9. Oklahoma State University, Stillwater, Oklahoma
10. California Polytechnic State University, San Luis Obispo, California
11. Syracuse University, Syracuse, New York.

Three of the schools listed above are in the Big Ten, and at least four are regarded by The Ohio State University administration as peer institutions.

17. J. Gourman (1998), *The Gourman Report*, 10th ed., Random House, Inc., New York

7. Enrollment Patterns in Similar Programs

Enrollments in ABET-accredited Environmental Engineering programs range anywhere from several students (Columbia and Tulane Universities) to as many as 190 (Humboldt State University). The median enrollment is 34 students, and the average enrollment is 51 students. The Ohio State University's current enrollment of 35 students is more or less typical.

Although most programs do not keep track of part-time students, the programs that do report very few. Again, this is typical of Ohio State's experience. However, with the greater visibility offered by a labelled degree (BSEnE), and with the large number of environmental engineering companies with local offices, we may expect our part-time enrollments to increase.

The current Environmental Engineering Option in Civil Engineering here at Ohio State also serves students in other departments, especially Chemical and Biomolecular Engineering, which typically provides us with eight to 12 students in some courses.

8. Opportunities for Employment and Graduate Studies

Between 2004 and 2014, environmental engineering employment is projected to increase by more than 27% from its 2004 level of 50,120 to at least 64,000.¹⁸ Only computer science and engineering and biomedical engineering are projected to have a higher percentage growth rate.

Starting salaries for BS environmental engineers in 2003 were about \$45,000. In 2004, the median salary for all environmental engineers (BS, MS, and PhD) was \$68,000, and the first and ninth deciles were \$42,000 and \$99,000, respectively.

Currently, about 1500 BSEnE positions are advertised each year. This is three times the number of BSEnE degrees awarded. In 2002-2003, 474 BS degrees were awarded, 267 to men and 207 to women.¹⁹ In 2005-2005, the number of BSEnE degrees awarded increased to 522 (10% over previous year), and an additional 212 BSCE degrees with an environmental engineering minor were also awarded.

18. Bureau of Labor statistics, www.bls.gov. Occupation 17-2081 Environmental Engineers.

19. http://nces.ed.gov/programs/digest/d04/tables/dt04_253.asp. Another 489 MS degrees (275 men, 214 women and 85 PhD degrees (60 men, 25 women) were also awarded.

Graduates of the existing Environmental Engineering Option in Civil Engineering (who receive the BSCE degree) have been hired by a wide variety of organizations, and we expect the even better-prepared BSEnE holders will continue this record of success.

A major class of employer is consulting engineering companies. For historical and regulatory reasons, environmental engineering services are usually provided by independent engineering companies, often organized as partnerships. These companies provide both governments and manufacturers with engineering planning, design, investigation and construction management services. There are at least 36 environmental engineering consulting companies in central Ohio. Many of the major national environmental engineering consultants have regional offices here—including such prestigious companies as Black and Veatch; Camp, Dresser & McKee; CH₂M-Hill; Malcolm Pirnie, Inc.; Metcalf & Eddy; and URS, Inc. In addition, there are a number of firms headquartered locally—*e. g.*, Battelle Memorial Institute, Burgess & Niple, DLZ, Inc.; Stilson and Associates., and Zande and Associates. The fact that so many companies are present locally provides our students and graduates with many opportunities for co-operative work-study, internships and permanent professional employment. Our students and graduates work for all of these companies. In turn, The Ohio State University offers employees of these companies many opportunities for continuing education in engineering, business management, law, chemistry, biology, geology, statistics and other relevant fields.

Federal, state and local governments also employ environmental engineers in a variety of their agencies. Most commonly, these agencies are concerned with environmental, health and safety regulation, environmental monitoring and the operation and management of pollution abatement facilities. Examples at all three levels are the US Environmental Protection Agency, US Army Corps of Engineers, US Occupational Health and Safety Administration, Ohio Environmental Protection Agency, Ohio Department of Natural Resources, Franklin County Health Department and City of Columbus Division of Water and the Division of Sewerage and Drainage. Again, our students and graduates work for all these agencies at all levels of government.

All manufacturing companies must comply with a variety of federal, state and local environmental regulations, and they maintain engineering departments dedicated to certifying and maintaining that compliance. Our graduates have worked for a number of manufacturers in central Ohio and elsewhere—such as Capital Resin, Inc., General Electric, Lincoln Electric, Nalco Chemical Corp., and Scott's.

There are at least 106 graduate programs in the United States and Canada that offer the MS and/or PhD in Environmental Engineering programs.²⁰ Graduates of Ohio State's BSEnE would be eligible for admission to any of these programs. In fact, many graduates of our current Environmental Engineering Option in Civil Engineering program have gone on to get graduate degrees at the most prestigious graduate programs in the United States, including schools like University of California at Berkeley, University of Michigan, Massachusetts Institute of Technology, and the University of Texas at Austin. Finally, students use our undergraduate environmental engineering program as preparation for business, law or medical school, and we have had a number of graduates who have followed those career routes.

9. Preparation for Licensure and Certification

Graduates of the proposed degree program will be eligible to sit for the professional engineers licensing examination (Parts I and II) in Environmental Engineering.²¹ This examination is prepared and coordinated by the National Council of Examiners for Engineering and Surveying (NCEES), and it is accepted by all 50 states, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam and the Northern Mariana Islands.

The American Academy of Environmental Engineers (AAEE) also offers board certification in various environmental engineering specialties to licensed Professional Engineers who take and pass the AAEE examination. Engineers who are board-certified receive the Diplomat in Environmental Engineering (DEE).

20. M. R. Collins and G. L. Amy, ed. (1996), *Register of Environmental Engineering Graduate Programs*, 8th ed., Association of Environmental Engineering Professors, Champaign, IL. (See the AEESP web site for the most recent listings: www.aeesp.org)

21. Students who enroll in our Environmental Engineering Option in Civil Engineering, and who receive the BSCE degree, are also eligible to sit for this examination.

III. Relationship to Other Programs

1. Cooperative Relationships with other Institutions and Organizations

The proposed Bachelor of Science in Environmental Engineering does not involve formal cooperative agreements with other institutions or organizations.

2. Articulation Arrangements with other Institutions

The proposed Bachelor of Science in Environmental Engineering does not involve or require any articulation arrangements with other institutions.

3. Consultants and Advisory Committees

An Environmental Engineering Advisory Committee has been established to formalize and facilitate cooperation between The Ohio State University's Environmental Engineering Program and interested parties in Ohio. The Committee includes representatives of environmental engineering consulting companies, manufacturing companies and government agencies. We hope to add representatives of citizens groups. The current membership (January 2006) of the Advisory Committee to the ABET-accredited Environmental Engineering Option in Civil Engineering is,

Ken Davis, PE
Burgess & Niple, Inc.
5085 Reed Rd.
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(614) 459-2050
KDavis@burnip.com

Sam Jeyanayagam, PhD, PE, DEE., Senior Associate
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The Environmental Engineering Undergraduate Studies Committee also has been advised by several senior environmental engineering practitioners, including Dr. Neil Drobny of ERM, Inc., Mr. Gregory Koltun of the United States Geological Survey, Mr. James Morris of the Ohio Department of Natural Resources, and Dr. Richard Noss of FMSM, Inc. These individuals have also served as adjunct faculty teaching some of our courses.

The Environmental Engineering program also benefits from the existing Advisory Committees of the College of Engineering and the Department of Civil and Environmental Engineering and Geodetic Science and from the Department's Alumni Association. These groups are made up of prominent engineers in the practice community. They meet regularly a few times a year, and they provide valuable advice concerning all aspects of our programs.

4. Overlaps with other Programs and Departments in the University

There are no significant overlaps with other programs. However, several other schools and departments have interests in environmental engineering and science and maintain programs that are complementary to the proposed BSEnE programs. Letters of concurrence are attached beginning on page 17. These include letters from:

1. Department of Chemical and Biomolecular Engineering;
2. Department of Chemistry;
3. Department of Food, Agriculture and Biological Engineering;

4. Department of Geological Sciences (now the School of Earth Sciences);
5. School of Natural Resources (now the School of Environment and Natural Resources); and
6. School of Public Health.

5. Previous Submissions and Reasons for Rejection or Withdrawal

This is the first submission for the proposed BS Environmental Engineering degree.

6. Minimum Admission Requirements and/or Qualifications

Students enrolled as pre-Environmental Engineering will be advised by the Undergraduate Academic Advisor for the Department of Civil and Environmental Engineering and Geodetic Science.

The minimum requirements for admission to Environmental Engineering for pre-Environmental Engineering students are:

1. a cumulative point hour ratio (CPHR) of 2.0 in all courses taken at The Ohio State University or other four-year colleges or universities prior to admission to the BS in Environmental Engineering program;
2. a subsidiary point hour ratio (SPHR) of 2.0 (based on all grades earned in all attempts of courses in this group) in the following pre-Environmental Engineering courses: Chemistry 121 and 125; Engineering 181 and 183; Engineering Graphics 167; Mathematics 151, 152, and 153; and Physics 131, 132 and 133.

The pre-Environmental Engineering courses are normally taken during the freshman year. English 110 and Engineering 100 should also be taken at this time.

Special consideration will be given to members of under-represented groups in Environmental Engineering.

Domestic transfer students seeking direct admission into a major of the College of Engineering must meet the same individual requirements as students transferring from within The Ohio State University. Additionally, there will be an evaluation of the student's former curriculum by the College of Engineering and the Department of Civil and Environmental Engineering and

Geodetic Science. Students transferring from institutions lacking regional accreditation must have a minimum CPHR of 3.0 on a scale of 4.0.

The Undergraduate Academic Advisor for the Department of Civil and Environmental Engineering and Geodetic Science also monitors the evaluation of transfer credit. The sequence in which transfer credit is evaluated coincides with the sequence in which the courses appear in the curriculum. The Transfer Student Advisor will designate which courses are to be evaluated and will determine the faculty member who is to perform the evaluation. Transfer courses are not equivalent to OSU courses unless the prerequisites are substantially equivalent. The awarding of transfer credit from foreign, non-ABET, or non-CAB accredited institutions normally will be by examination in the Department of Civil and Environmental Engineering and Geodetic Science.

7. Source of Students (existing programs, outside university)

It is expected that the initial source of students will be those BSCE majors who would have enrolled in the current Environmental Engineering Option in Civil Engineering, which is to be discontinued and replaced by the proposed BSEnE degree. Some of these students will choose to pursue a more traditional civil-sanitary engineering program leading to the BSCE, and a civil-sanitary option within the BSCE degree program will be available to them. Some BSCE majors may also wish to take the Environmental Engineering Minor, which was approved Winter Quarter, 2005.

Based on past experience, we also expect that a few students will transfer from the BS Chemical and Biomolecular Engineering, BS Food, Agriculture and Biological Engineering and BS Environmental Science programs.

However, the biggest future source of new students is expected to be students who enrolled in out-of-state universities, because OSU's existing Environmental Engineering Option in Civil Engineering program is not advertised prominently in the literature or web sites of the University or College of Engineering.²²

22. The policy of the University and College of Engineering is to advertise degree programs only.

IV. Student Enrollment

1. Expected Number of Students Admitted Each Year

Table 1. Annual Admissions to Program

Student Category	Year 1	Year 2	Year 3	Year 4
Full-Time*	10	18	21	24
Part-Time*	0	0	0	0
Other* [†]	8	8	8	8

* Based on historical enrollment for existing Environmental Engineering Option since 1973

[†] Baccalaureate students enrolled in the Department of Chemical Engineering who take technical electives in environmental engineering offered by the Department of Civil and Environmental Engineering and Geodetic Science.

There will be no summer enrollments, and no Environmental Engineering course offerings are planned for Summer Quarter.

V. Degree Requirements

1. Required Courses

Note: All courses are offered currently. No new courses are proposed.

Table 2. Required BS Environmental Engineering Courses

Department and Course No.	Title	Credit Hours	Description
University General Education Curriculum (GEC) Requirements (40 cr. hr.; 1 cr. hr. in each of CE 405, 406 and ENE 619 count as Additional Writing Instruction in Regular Courses)			
Economics 200	Principles of Microeconomics	5	Introduction to economic theory; supply and demand for goods and services; market structure; the distribution of income.
English 110	First Year English Composition	5	Practice in the fundamentals of expository writing, as illustrated in the student's own writing and in the essays of professional writers.
varies 367	Intermediate Essay Writing	5	varies
History xyz	History Course	5	varies
History xyz	History Course	5	varies
varies xyz	Literature Course	5	varies (may be replaced by an ethics course)
varies xyz	Second Social Science Course	5	varies (may be replaced by an ethics course)
varies xyz	Visual or Performing Arts Course	5	varies
varies xyz	varies (Ethics)	5	To be taken in lieu of either a Social Science course (but not History) or a Humanities course from an approved list of ethics-related courses.
College of Engineering Core and Select Core (85cr. hr.; 1 cr. hr. in each of CE 405 and 406 counts for GEC writing requirement)			
Chemistry 121	General Chemistry	5	First course for science majors and engineering students, covering dimensional analysis, atomic structure, the mole, stoichiometry, chemical reactions, electron configuration, periodicity, bonding, and molecular structure.
Chemistry 125	Chemistry for Engineers	4	Continuation of 121 for science majors and engineering students, covering acids and bases, redox reactions, gases, liquids, solids, solutions, colligative properties, thermochemistry, kinetics, and chemical equilibrium.
Civil Engineering 405	Observational Analysis	5	Theory and application of observational analysis [probability and statistics].
Civil Engineering 406	Fundamentals of Civil Engineering Analysis	5	Application of numerical methods to problems in civil engineering.
Environmental Engineering 576	Civil and Environmental Engineering Economics and Planning	4	Engineering economics and theories of planning applied to private and public civil works.
Engineering 100	Engineering Survey	1	Academic requirements; University procedures, grading system, and resources; overview of engineering areas of study and services.

Table 2. Required BS Environmental Engineering Courses

Department and Course No.	Title	Credit Hours	Description
Engineering 181	Introduction to Engineering I	3	Visualization and sketches, introduction to spreadsheets and MATLAB; experimental design and data analysis; problem solving approaches; hands-on lab.
Engineering 183	Introduction to Engineering II	3	Team building, design-build project, written and oral reports, introduction to CAD, working drawings, preparation of visual aids.
Engineering Graphics 167	Problem Solving through Programming for Engineering Calculations and Computer Graphics	4	Solving engineering problems using computer programming; development of algorithms and program modules; solutions to major problems will be presented in an engineering report format.
Mathematics 151	Calculus and Analytical Geometry	5	Limits, continuity, derivatives, Mean Value theorem, extrema, curve sketching, related rates, differentiation of trig, log and exponential functions.
Mathematics 152	Calculus and Analytical Geometry	5	Integral area, fundamental theorems of calculus, logarithmic and exponential functions, trigonometric and inverse trigonometric functions, methods of integration, applications of integration, polar coordinates.
Mathematics 153	Calculus and Analytical Geometry	5	Indeterminate forms, Taylor's formula, improper integrals, infinite series, parametric curves, and vectors in the plane; vectors, curves and surfaces in space.
Mathematics 254	Calculus and Analytical Geometry	5	Partial differentiation, Lagrange multipliers, multiple integrals, line integrals and Green's theorem.
Mathematics 415	Ordinary and Partial Differential Equations	4	Ordinary, partial, linear and nonlinear differential equations; Fourier series; boundary value problems; Bessel functions.
Mechanical Engineering 410	Statics	4	Vector concepts of static equilibrium for isolated and connected bodies; centroids, inertia; truss, frame, and machine analysis; shear force and bending moment diagrams; friction.
Mechanical Engineering 420	Strength of Materials	4	Stress and strain analysis of structural components subjected to unidirectional and combined loads; pressure vessels; beam deflections; Mohr's circle; columns.
Mechanical Engineering 430	Dynamics	4	Dynamics of particles and rigid bodies; linear and angular motion; work and energy; single degree of freedom vibration analysis.
Physics 131	Particles and Motion	5	Major concepts of physics from a contemporary point of view; for students in physical sciences, mathematics or engineering.
Physics 132	Electricity and Magnetism	5	Continuation of 131.
Physics 133	Thermal Physics, Waves and Quantum Mechanics	5	Continuation of 132.
Environmental Engineering Required Courses (75 total cr. hr.; 1 cr. hr. of CE 619 counts as part of GEC writing requirement)			

Table 2. Required BS Environmental Engineering Courses

Department and Course No.	Title	Credit Hours	Description
Chemical and Biomolecular Engineering 771	Air Pollution	3	Sources of air pollutants, properties of small particles, chemistry of air pollution, dispersion and deposition of air pollutants, and air pollution control
Chemistry 221	Analytical Chemistry I	5	Analytical chemistry for chemistry majors; quantitative analysis of the elemental and molecular composition of complex systems
Chemistry 231	Introduction to Organic Chemistry	3	A condensed introduction to organic chemistry organized by functional groups with an emphasis on practical applications.
Chemistry 520	Physical Chemistry	3	The principles of physical chemistry for students in the biological sciences and for BA students majoring in chemistry.
Chemistry 521	Physical Chemistry	3	Continuation of 520.
Chemistry 587	Analytical Chemistry II	3	Applications of physico-chemical principles to problems of quantitative analysis
Environmental Engineering 413	Fluid Mechanics	4	Fluid properties; fluid statics; flow concepts; continuity, energy, and momentum equations; dimensional analysis and dynamic similarity; viscous effects; drag; basic pipe flow; lab demonstrations and experiments.
Environmental Engineering 460	Professional Aspects of Civil and Environmental Engineering	1	Structure of the civil engineering profession; interaction of civil engineers with the education process, their clients, other professions and the public
Environmental Engineering 511	Introduction to Environmental Engineering	3	Quantitative analysis of water, air and noise pollution, hazardous waste management, ionizing radiation, occupational and environmental health engineering, and pollution prevention.
Environmental Engineering 516	Water Resources Engineering	4	Pipe systems, introduction to open channel flow, basic hydrology, demographic studies, water supply, and wastewater flows.
Environmental Engineering 520	Treatment Plant Design	4	Selection and design of processes for the purification of natural and used waters.
Environmental Engineering 540	Civil and Environmental Engineering Systems	4	Basic concepts and methods of systems engineering and applications to civil engineering problems in transportation and water resources planning, structural design, and construction management.
Environmental Engineering 610	Analysis of Natural and Polluted Water	3	A laboratory study of the measurement and interpretation of water quality indices and pollution parameters, including BOD, COD, alkalinity, nutrients, pH, and heavy metals.
Environmental Engineering 619	Environmental Engineering Capstone Design Course	4	Experimental and design laboratory for water supply collection, transmission, distribution and measurement systems, sewage and storm water collection and disposal and measurement systems.

Table 2. Required BS Environmental Engineering Courses

Department and Course No.	Title	Credit Hours	Description
Environmental Engineering 620	Treatment Plant Design Laboratory	2	A laboratory demonstration of the treatment processes discussed in 520 and an introduction to pilot-testing procedures for environmental engineering students.
Environmental Engineering 711	Bioremediation of Used Water	4	Principles and design of biological processes for used water treatment.
Environmental Engineering 717	Municipal and Industrial Solid Waste Management	4	Characterization and sources of solid wastes; solid waste management; collection systems; processing; disposal; and recycling.
Microbiology 509	Basic and Practical Microbiology	5	Provides and understanding of microorganisms and their interaction with the human experience.
Soil Science 300	Soil Science	5	Introduction to soil physical, chemical and biological properties related to land use, environmental quality, and crop production. Observation and quantitative of soil properties.
Technical Elective	varies	11	varies

2. Cross-Referencing with Civil Engineering

Many courses in Civil Engineering (with the CE prefix) will be used in the proposed BSEnE curriculum. In order to enhance visibility of the BSEnE, it is proposed that most of these courses be cross-listed as Environmental Engineering courses with a ENE prefix.²³ Some Civil Engineering courses would be better listed in the Course Offerings Bulletin as Environmental Engineering without cross-listing with Civil Engineering. The following table summarizes the proposed cross-listing and relistings. CE 618 is presently cross-listed with the School of Natural Resources (prefix SNR) and the Department of Food, Agricultural and Biological Engineering (prefix FABE).

The required Course Change and New Course forms are attached as Appendix K

23. This prefix is chosen to avoid confusion with the traditional Electrical Engineering prefix EE. The new department name of Electrical and Computer Engineering uses the prefix ECE.

Table 3. Cross-Listing and Relisting of Civil Engineering Courses and Environmental Engineering Courses

Course Number	Old Course Name	New Course Name	Old Prefix	New Prefixes
413	Fluid Mechanics	Fluid Mechanics	CE	CE/ENE
460	Professional Aspects of Civil and Environmental Engineering	Professional Aspects of Civil and Environmental Engineering	CE	CE/ENE
511	Introduction to Environmental Engineering	Introduction to Environmental Engineering	CE	ENE
516	Water Resources Engineering	Water Resources Engineering	CE	CE/ENE
520	Design of Treatment Facilities	Design of Treatment Facilities	CE	CE/ENE
540	Civil Engineering Systems	Civil and Environmental Engineering Systems	CE	CE/ENE
576	Civil Engineering Economics and Planning	Civil Engineering Economics and Planning	CE	CE/ENE
590	Environmental Engineering Process Development	Environmental Engineering Process Development	CE	ENE
610	Analysis of Natural and Polluted Waters	Analysis of Natural and Polluted Waters	CE	ENE
613	Applied Hydrology	Applied Hydrology	CE	CE/ENE
618	Ecological Engineering	Ecological Engineering	CE/ FABE/ SNR	ENE/ FABE/ SNR
619	Environmental Engineering Capstone Design	Environmental Engineering Capstone Design	CE	ENE
620	Treatment Plant Design Laboratory	Treatment Plant Design Laboratory	CE	ENE
624	Coastal and Ocean Engineering	Coastal and Ocean Engineering	CE	ENE
640	Civil and Environmental Systems Engineering	Civil and Environmental Systems Engineering	CE	CE/ENE

Table 3. Cross-Listing and Relisting of Civil Engineering Courses and Environmental Engineering Courses

Course Number	Old Course Name	New Course Name	Old Prefix	New Prefixes
693	Individual Studies	Individual Studies	CE	CE/ENE
694	Group Studies	Group Studies	CE	CE/ENE
711	Biological Processes for Used Water Treatment	Bioremediation of Used Waters	CE	ENE
713	Water Quality and Environmental Measurements	Water Quality and Environmental Measurements	CE	ENE
714	Hazardous Waste Management	Hazardous Waste Management	CE	ENE
715	Water Resources Systems: Water Supply	Water Resources Systems: Water Supply	CE	ENE
717	Municipal and Industrial Solids Waste Management	Municipal and Industrial Solids Waste Management	CE	ENE
718	Strategies for Industrial Environmental Management	Strategies for Industrial Environmental Management	CE	ENE
719	Water Quality Modeling	Water Quality Modeling	CE	ENE
720	Environmental Engineering Risk Assessment	Environmental Engineering Risk Assessment	CE	ENE
722	River and Open Channel Hydraulics	River and Open Channel Hydraulics	CE	CE/ENE
723	Transport Phenomena in Water Resources Engineering	Transport Phenomena in Water Resources Engineering	CE	CE/ENE
760	Civil and Environmental Engineering Planning	Civil and Environmental Engineering Planning	CE	CE/ENE
771	Radioactive Waste Management	Radioactive Waste Management	CE/NUE	ENE/NUE
783H	Honors Research	Honors Research	CE	CE/ENE
797	Interdepartmental Seminars	Interdepartmental Seminars	CE	CE/ENE

Table 3. Cross-Listing and Relisting of Civil Engineering Courses and Environmental Engineering Courses

Course Number	Old Course Name	New Course Name	Old Prefix	New Prefixes
798	Current Topics in Environmental Science and Engineering	Current Topics in Environmental Science and Engineering	CE	ENE

- 3. Minimum Number of Credit Hours for Completion** 200
- 4. Expected Average Number of Credit Hours at Completion** >200

5. Average Number of Credit Hours Taken per Quarter by Typical Student

The proposed BSEnE program contains 200 quarter credit hours, which means that students must take 16 to 17 credit hours per quarter to complete the program in four years. A typical schedule is shown in Appendix B on page 70.

Table 4. Average Quarterly Credit Hour Load on Students

Category	Year 1	Year 2	Year 3	Year 4
Full-Time	16.7	16.7	16.7	16.7
Part-Time	8	8	8	8

6. Required Courses in Other Departments

The proposed BSEnE program requires that a total of at least 126 quarter credit hours be taken in departments other than Civil and Environmental Engineering and Geodetic Science (CEEGS). At least 55 credit hours (including Eng Graph 167) must be taken within CEEG. The 19 technical elective credit hours may be taken in any department, as long as they are approved by an Environmental Engineering faculty member.

Table 5. Required Credit Hours in Other Departments

Department	Credit Hours	Level
Chemical and Biomolecular Engineering	3	upper
Chemistry	17	lower
	9	upper
Economics (GEC)	5	lower
Engineering	7	lower

Table 5. Required Credit Hours in Other Departments

Department	Credit Hours	Level
English (GEC)	10	lower
History (GEC)	10	lower
Mathematics	24	lower
Mechanical Engineering	12	lower
Microbiology	5	upper
Physics	15	lower
Soil Science	5	lower
Other non-CEEGS GEC	15	lower

7. Elective Courses in Other Departments

A wide variety of courses in engineering and the natural and social sciences are relevant to Environmental Engineering. The following table lists some of the departments in which students in the current Environmental Engineering Option in Civil Engineering have taken courses. We expect this pattern to continue and to expand to other departments as the enrollments in the BS Environmental Engineering program grow.

Table 6. Possible Elective Course Hours in Other Departments

Department	Credit Hours	Level
Chemical and Biomolecular Engineering	3	upper
Chemistry	6 3	lower upper
Entomology	6	upper

Department	Credit Hours	Level
Food, Agricultural & Biological Engineering	8	upper
Geological Sciences	20	upper
Industrial, Systems & Welding Engineering	3	upper
Environmental & Natural Resources	7	upper
Nuclear Engineering	3	upper
Soil Science	5	upper

8. Other Degree Requirements (exit criteria)

None.²⁴

9. Methods Used for Program Evaluation²⁵

Assessment methods for the Environmental Engineering program have been developed and applied over the last six years as part of the ABET accreditation process. Program constituents are current students in the existing Environmental Engineering Option in Civil Engineering program, its graduates, employers and faculty at OSU and elsewhere who may be graduate school advisors of our graduates. Except for graduate school advisors, each of these constituencies has been surveyed annually beginning in the 1998-1999 academic year as part of the assessment process that was developed. Students enrolled in the program for 2001-2002 were also surveyed regarding their preference for the BSEnE and BSCE degree programs. The constituencies were actively involved in the establishment of the Program Objectives. The formal surveys provided

24. A voluntary exit survey is conducted to identify program strengths and weaknesses.

25. See Figure 1. Flowchart of the ABET Process for Environmental Engineering on page 56.

feedback on how well the Program was meeting its stated objectives and whether new objectives were needed.

Assessment tools include:

1. Student Evaluation of Instruction (SEI) forms run for every course offering;
2. an extensive special-purpose survey of every course in the curriculum administered in the 1998-1999 academic year;
3. on-going voluntary exit surveys of all graduating seniors;
4. annual reports of Engineering Career Services, College of Engineering.
5. annual alumni surveys;

Also, four special-purpose alumni surveys were conducted by the College of Engineering on the topics of Business/Management (Winter, 2000), Life-Long Learning (Winter 2001), Professional Ethics and Practice (Winter, 2002) and Liberal Arts (Winter, 2002).

The process for ensuring that the Program Educational Objectives are being met is shown in Figure 1. Flowchart of the ABET Process for Environmental Engineering on page 56. There are six major stages in the process:

1. Mission Statements,
2. Program Objectives,
3. Program Strategies and Actions,
4. Program Outcomes,
5. Assessment, and
6. Feedback.

Based on the statements of program objectives, specific course-based and non-course-based program strategies and actions were developed to meet the objectives. Because the coursework has been (and will continue to be) a fundamental strategy used by the program to achieve its objectives, it was decided to list specific course objectives, strategies and actions, learning outcomes, and assessment tools for virtually every course in the curriculum.

Many program strategies do not involve coursework at all. An example is, "Faculty and advisors will act as mentors to students to encourage them to obtain part-time jobs and internships in engineering as undergraduates." Specific Program Outcomes and Assessment methods had to be stated for this strategy, as called for in the left branch of the flow chart.

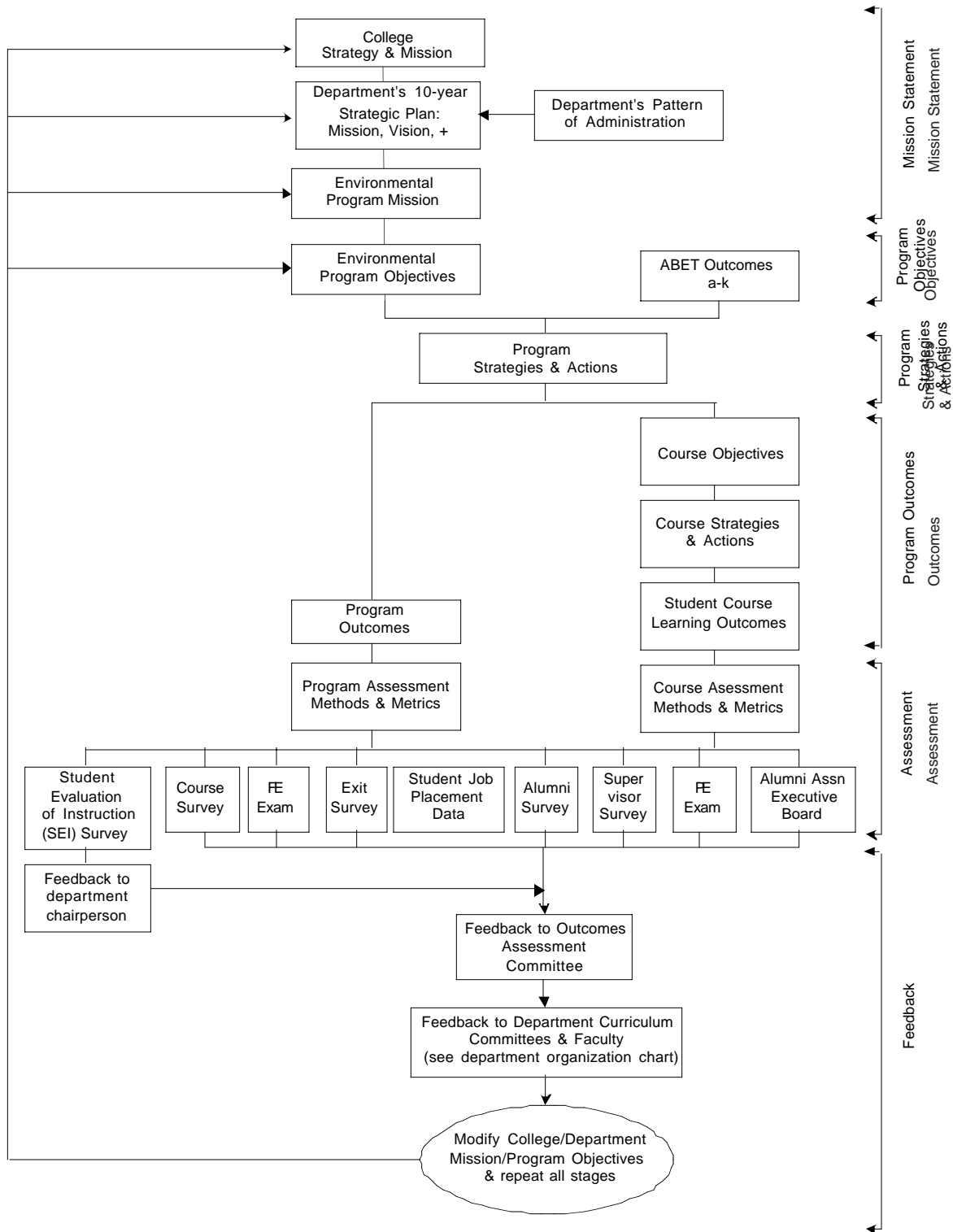


Figure 1. Flowchart of the ABET Process for Environmental Engineering

10. Accreditation Agency and Requirements

The official accreditation agency for all engineering programs in the United States is the Accreditation Board for Engineering and Technology (ABET), an arm of the Engineering Accreditation Commission (EAC). The criteria used by ABET during the last OSU EAC general accreditation review (Fall, 1999) are provided in Appendix B on page 70. These include both the general criteria used for all programs, as well as the program-specific criteria for environmental engineering programs.

The criteria are very comprehensive and demanding. The Environmental Engineering Option in Civil Engineering was first accredited in Fall, 1993, and was re-accredited in Fall, 1996, 1999 and 2001. On the last accreditation visit on November 18 through 20, 2001, no program deficiencies, weaknesses, or concerns were found.²⁶

11. Number and Qualifications of Full-Time and Part-Time Faculty

No additional faculty are required to run the program. As shown in Table 7. Current Faculty on page 58, the program currently has 6.5 FTE faculty. In addition to teaching the 35 undergraduate students enrolled in the Environmental Engineering Option in Civil Engineering, these faculty also advise 24 MS and PhD students in the environmental engineering graduate program and offer six service courses²⁷ to more than 250 BS Civil Engineering and 10 to 15 BS Chemical and Biomolecular Engineering students. Their teaching load amounts to one-eighth of the total student credit hours generated by the Department. The faculty also maintains externally funded research programs. Three of the faculty are registered professional engineers.

26. Accreditation Board for Engineering and Technology, *Final Statement, Environmental Engineering Option in Civil Engineering*, September, 2002.

27. CE 413, 460, 516, 520, 540, and 576.

Table 7. Current Faculty^a

Name	Area	Rank	Graduate Faculty Status	Percentage Time in Program
Diane Foster	Fluid Mechanics	Assistant Professor	P	50
John Lenhart	Surface Chemistry	Assistant Professor	P	100
Robert M. Sykes	Biological Processes	Professor	P	100
Harold W. Walker	Chemical Processes	Associate Professor	P	100
Linda K. Weavers	Chemical Processes	Associate Professor	P	100
E. Earl Whitlatch	Environmental Systems	Associate Professor	P	100

a. Searches are underway to replace Prof. Keith W. Bedford (fluid mechanics) who has retired, and Assist. Prof. Timothy Granata who has left the University.

VI. Program Description

1. College of Engineering Departments and Degrees: Degree Programs and Minors [http://www.eng.ohio-state.edu/academic/degree_programs/index.php]

Link to: Bachelor of Science in Environmental Engineering

Instructional Programs

Environmental Engineering

470 Hitchcock Hall, 2070 Neil Avenue, Columbus, Ohio 43210-1275; 614-292-2005

Program Educational Objectives

- Provide a new generation of Environmental Engineers with a solid foundation in analytical tools (mathematical and computational), basic sciences, engineering sciences, and engineering design to promote outstanding professional practice;
- Environmental Engineering faculty will utilize modern classrooms and laboratories, and incorporate sound teaching technologies, methodologies, and learning theory at the undergraduate level;
- Provide a new generation of Environmental Engineers with effective skills in water resources and environment engineering project planning, design, and implementation, within the context of contemporary societal and global issues;
- Motivate undergraduate Environmental Engineering students to continue their education in graduate school and life-long learning;
- Faculty and students will be active participants in Environmental Engineering public policy formulation, professional activities, and public service.

Undergraduate program

Environmental engineering is the planning, design, construction, operation, and maintenance of constructed facilities for the protection of human health and safety and the preservation of wildlife and the environment. It includes water supply and resources, environmental systems modeling, environmental chemistry, wastewater management, solid waste management, hazardous waste management and remediation, atmospheric systems and air pollution control, and environmental and occupational health. Typical environmental engineering projects are large, one of a kind, and important in the daily lives of a great many people. Graduates of environmental engineering programs are found in engineering and administrative posts in industry, construction, research, government, and consulting firms.

Environmental engineers need to be versed in a number of disciplines in order to cope with the various problems in the practice of their profession. In the environmental engineering curriculum at The Ohio State University, students study: fundamental mathematics and science, on which

much of engineering is based; social sciences and humanities, to broaden their perspectives and to prepare them for professional interaction with people; a core of basic environmental engineering subject areas, including courses in biology and ecology, chemistry, hydraulics, air and water treatment processes, risk assessment and management, economics and planning, environmental modeling, and applied mathematics.

Several major elective options are available:

- water and wastewater distribution and collection, and the design of water and wastewater treatment facilities;
- air pollution dispersion and transport, and the design of air pollution abatement facilities;
- solid waste engineering, management, processing and recycling;
- hazardous and radioactive waste engineering and management;
- environmental modeling and planning;
- hydraulics, hydrology, environmental fluid mechanics, water resource systems analysis and planning, and coastal engineering;
- environmental health and safety;
- risk assessment; and
- ecological engineering

Sample Curriculum

The following curriculum and list of minimum requirements for the degree Bachelor of Science in Environmental Engineering establish a framework within which students can develop a program of study that meets their needs. Detailed descriptions of elective options, which are dynamic and flexible, can be obtained at the Department of Civil and Environmental Engineering and Geodetic Science office. Students are invited to contact the Department at their earliest opportunity to obtain further information about the program. Each student admitted to the program will be assigned a faculty technical adviser who will provide additional guidance in the design of a personal program of study.

The following curriculum and list of minimum requirements for the degree Bachelor of Science in Environmental Engineering are in effect for all students entering the university without prior college credit.

Table 8: Sample Curriculum for Bachelor of Science in Environmental Engineering (leading to the BSEnE degree; 200 cr. hr.)

Year	Autumn	cr. hr.	Winter	cr. hr.	Spring	cr. hr.
Freshman	Math 151 Calc. & Anal. Geom.	5	Math 152 Calc. & Anal. Geom.	5	Math 153 Calc. & Anal. Geom.	5
	Chem 121 General Chemistry I	5	Chem 125 Chemistry for Engineers	4	Phys 131 Particles & Motion	5
	Eng'g 181 Intro. Engineering I	3	Eng'g 183 Intro. Engineering II	3	EnGraph 167 Programming	4
	Eng 100 Engineering Survey	1	Engl 110 First-Year English Composition	5	Econ 200 Principles of Microeconomics	5
subtotal		14		18		19
Sophomore	Math 254 Calc. & Anal. Geom.	5	Phys 133 Thermo. & Quantum Mech	5	Chem 231 Intro. Organic Chem.	3
	Phys 132 Electricity & Magnetism	5	ME 420 Strength of Materials	4	CE 405 Prob. & Statistics	5
	ME 410 Statics	4	Math 415 Ord. & Part. Diff. Eq.	4	ME 430 Dynamics	4
	GEC/TE	varies	GEC/TE	varies	ENE 511 Intro. Environmental Eng'g	3
subtotal		>14		>13		15
Junior	Chem. 221 Anal. Chem.	5	Chem 520 Phys. Chem.	3	Chem 521 Phys. Chem.	3
	ENE 413 Fluid Mechanics	4	CE 406 Numerical Methods	5	ENE 460 Prof. Aspects Eng'g	1
	ENE 540 Civil & Env. Eng'g Systems	4	ENE 516 Water Resources Eng'g	4	ENE 520 Treatment Plant Des.	4
	GEC/TE	vairies	Soil Sci 300	5	GEC/TE	varies
subtotal		>13		17		>8
Senior	ENE 610 Anal. Nat. & Pollut. Water	3	ENE 576 Eng. Plan. & Econ.	4	ENE 619 Capstone Des. Project	4
	Micro 509 Microbiology	5	ENE 620 Treat. Plant Des. Lab.	2	ENE 717 Solid Waste Mgt.	4
	GEC/TE	varies	ENE 711 Biol. Process Des.	4	ChBE 771 Air Pollution	3
	GEC/TE	varies	Chem 587 Anal. Chem II	3	GEC/TE	varies

subtotal	>8	>10	>11
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Summary Of Requirements (200 cr. hr.):

1. University Requirements (40 cr. hr.; Additional Writing in Regular Courses, 3 cr. hr. total: 1 cr. hr. in each of CE 405, 406 and ENE 619)

Economics 200 (5)

English 110 (5)

Ethics Course (5) (to be taken in lieu of either a humanities course or a social science course)

History xyz (5), xyz (5)

Intermediate Essay Writing Course 367 (5) (department varies)

Literature Course xyz (5) (department varies; may be replaced by the ethics course)

Performing or Visual Arts (5) (department varies)

Social Science Course (5) (department varies; may be replaced by the ethics course)

2. College Core and Selected Core Requirements (85 cr. hr. total; 1 cr. hr. in each of CE 405 and 406 count as part of GEC writing requirement.)

Chemistry 121 (5), 125 (4)

Civil Engineering 405 (5), 406 (5),

Engineering 100 (1), 181 (3), 183 (3)

Engineering Graphics 167 (4)

Environmental Engineering 576 (4)

Mathematics 151 (5), 152 (5), 153 (5), 254 (5), 415 (4)

Mechanical Engineering 410 (4), 420 (4), 430 (4)

Physics 131 (5), 132 (5), 133 (5)

3. Professional Courses (75 cr. hr.; 1 cr. hr. of CE 619 counts as part of GEC writing requirement)

Chemical and Biomolecular Engineering 771 (3)

Chemistry 221 (5), 231 (3) or 251 (3), 520 (3), 521 (3), 587 (3)

Environmental Engineering 413 (4), 460 (1), 511 (3), 516 (4), 520 (4), 540 (4), 610 (3),
619 (4), 620 (2), 711 (4), 717 (4)

Microbiol 509 (5)

Soil Science 300 (5)

8 cr. hr. Technical Electives

Electives: The professional electives in the third and fourth years must be chosen with the advice and approval of a department faculty adviser. Pre-approved technical electives include:

Chemistry 251 (3), 252 (3), 253 (3)

Environmental Engineering 613 (3), 618 (4), 714 (3), 719 (3), 720 (3), 722 (4), 723 (4),
750 (4), 760 (5), 771 (3)

Entomology 694, 762

Food, Agricultural and Biological Engineering 625 (4), 650 (4), 652 (4)

Earth Sciences 651 (5), 717 (5), 718 (5), 719 (5), 751 (5), 752 (5), 754 (5)

Industrial, Systems and Welding Engineering 757 (3)

Natural Resources 201 (5), 355 (3), 627 (5), 675 (4), 752 (4), 770 (3)

Soil Science 680 (5)

Other courses may be used as technical electives with the approval of the adviser.

Transfer Students: Prospective transfer students should contact the department for information on transfer credit policies.

PART B

VII. Program Costs and Funding

1a. One-Time and Start-Up Costs

The proposed Environmental Engineering degree program would make use of the existing faculty, staff and facilities used to support the existing Environmental Engineering Option in Civil Engineering. No one-time or start-up costs are expected.

1b. Annual Rate Costs

The annual rate costs are identical to those of the existing Environmental Engineering Option in Civil Engineering. No new costs will be incurred

2. Cost Savings and Adjustments

No cost savings or adjustments are expected.

3. Proposed Sources of Funding

No one-time or start-up costs will be incurred. All proposed faculty, staff (including Graduate Administration Associates, Graduate Research Associates and Graduate Teaching Associates) offices, classrooms and laboratories are already in place and in use by the existing Environmental Engineering Option in Civil Engineering program that the proposed BSEnE will replace.

VIII. Facilities and Equipment Requirements

1. Existing Facilities and Equipment

The existing graduate and undergraduate environmental engineering programs in the Department of Civil and Environmental Engineering and Geodetic Science occupy office space on the third and fourth floor on Hitchcock Hall [HI 303, HI 403, HI 417(A, B, C, D, E and F), and HI 483) and laboratories in its basement (HI 008, 022 and 026). No additional facilities are needed for the proposed BSEnE degree program.

2. Additional University Resources Required

No additional University resources are required for the proposed BSEnE degree program.

4. Classrooms

No special classrooms are required for the proposed BSEnE degree program. No change in classroom usage from current Environmental Engineering Option in Civil Engineering will be needed.

5. Laboratory, Studio and other Special Facilities

No additional laboratory, studio or special facilities are needed for the proposed BSEnE degree program.

6. Office Space

No additional office space is needed for the proposed BSEnE degree program.

7. Special Space Requirements

There are no special space requirements for the BSEnE degree program.

Appendix A

History of Changes in ABET Requirements for the Environmental Engineering Option in Civil Engineering

Some sort of environmental engineering program has existed at Ohio State University since the establishment of the Department of Civil Engineering in the early 1870s. The Department of Civil and Environmental Engineering and Geodetic Science currently offers environmental engineering programs leading to the BSCE, MS and PhD degrees.

Program First Accredited in 1993

When first accredited in 1993, the Environmental Engineering Option in Civil Engineering had two required courses totaling 7 required credit hours, and 20 technical elective hours, for a total of 27 hours beyond the Civil Engineering core.²⁸

Addition Made in 1997 (net addition of 2 cr. hrs)

In order to improve the capstone design course and to have an additional hands-on laboratory course, CE 620: Treatment Plant Design Laboratory (2 cr. hrs), was created and added to the list of required courses. Required courses were now 9 hours, elective courses 18, maintaining a total of 27 cr. hrs.

Additions Required by ABET 1999 General Review (net addition of 12 cr. hrs)

ABET Program Criteria changed from those of 1993 to include the mandate that graduates must have "...proficiency in...a biological science (e.g., microbiology, aquatic biology) relevant to the program of study...". As a result, the course MB 509: Basic and Applied Microbiology (5 cr. hrs), previously an elective, was made a required course in the Major Option.

ABET Program Criteria changed from those of 1993 to include the mandate that graduates must have "...knowledge of introductory level fundamentals in the following focus areas: water supply and resources, environmental systems modeling, environmental chemistry, wastewater management, solid waste management, hazardous waste management, atmospheric systems and

28. The total number of technical elective credit hours required for the BSCE has fluctuated between 27 and 28 as the credit hours of certain required courses (mainly CE 460) have changed over the years. The current number of technical elective credit hours required is 28.

air pollution control, and environmental and occupational health...". As a result, a new course, CE 511: Introduction to Environmental Engineering (3 cr. hrs), was created and made a required course in the Major Option.

ABET Program Criteria changed from those of 1993 to include the mandate that graduates must have "...proficiency in advanced principles and practice in a minimum of three of the major focus areas...". As a result, the course CE 711: Biological Processes for Used Water Treatment (4 cr. hrs), previously an elective, was made a required course in the Major Option.

The result of these mandatory changes was that 21 credit hours became required, leaving 6 technical elective hours, for a total of 27 cr. hrs.

Addition Made in 2001 (net addition of 2 cr. hrs)

In 2001, the department adopted a new Engineering Core which included the substitution of ENG 181 and 183 (3 cr. hrs each) in place of Engineering Graphics 166 (4 cr. hrs). This resulted in an effective addition of two credit hours to the Civil Engineering Core, thereby reducing total hours available in the Environmental Engineering Major Option to 25, of which 21 were required and 4 were elective.

Additions Required by ABET 2005 General Review (net addition of 3 cr. hrs)

The May 8, 2006 Draft Statement from ABET concerning the Fall 2005 General Review states that "...the opportunity to perform design by means of design experiences integrated throughout all four major focus areas of environmental engineering is lacking because of the required instruction in advanced principles and practices of air pollution..." As a result, the course CBE 771: Air Pollution (3 cr. hrs) must be made a required course in the Major Option.

This means that soon 24 credit hours will be required, leaving only one elective hour. We consider this situation to be highly undesirable from an educational standpoint, and unattractive to undergraduates.

Appendix B

**Sample Schedules for the
Existing Environmental Engineering Option in Civil Engineering
and the
Proposed Bachelor of Science in Environmental Engineering**

Table 9. Sample Schedule for the Current ABET-Accredited Environmental Engineering Option in Civil Engineering (leading to the BSCE degree, 200 cr. hr.)

Year	Autumn	cr. hr.	Winter	cr. hr.	Spring	cr. hr.
Freshman	Math 151 Calc. & Anal. Geom.	5	Math 152 Calc. & Anal. Geom.	5	Math 153 Calc. & Anal. Geom.	5
	Chem 121 General Chemistry I	5	Chem 122 General Chemistry II	5	Phys 131 Particles & Motion	5
	Eng'g 181 Intro. Engineering I	3	Eng'g 183 Intro. Engineering II	3	EnGraph 167 Programming	4
	Eng 100 Engineering Survey	1	Engl 110 First-Year English Composition	5	Econ 200 Principles of Microeconomics	5
subtotal		14		18		19
Sophomore	Math 254 Calc. & Anal. Geom.	5	Phys 133 Thermo. & Quantum Mech	5	CE 405 Prob. & Statistics	5
	Phys 132 Electricity & Magnetism	5	ME 420 Strength of Materials	4	ME 430 Dynamics	4
	ME 410 Statics	4	Math 415 Ord. & Part. Diff. Eq.	4	CE 511 Intro. Environmental Eng'g	3
	GEC/TE		GEC/TE		GEC/TE	
subtotal		14		12		11
Junior	CE 400 Introduction to Surveying	4	CE 406 Numerical Methods	5	CE 520 Treatment Plant Des.	4
	CE 413 Fluid Mechanics	4	CE 570 Transportation Eng'g & Des.	4	CE 535 Reinf. Concrete Des.	5
	CE 451 Civil Eng'g Materials	4	CE 516 Water Resources Eng'g	4	CE 554 Geotechnical Eng'g	4
	CE 540 Civil Eng'g Systems	4	CE 431 Structural Eng'g Principles	3	EE 300 Electrical Circuits	3
subtotal		16		16		16
Senior	ME 500 Thermodynamics	4	CE 576 Civil Eng'g Economics & Plan.	4	CE 619 Capstone Design Project	4
	CE 610 Environ. Eng'g Chem.	3	CE 620 Treatment Plant Des. Lab.	2	CE 717 Solid Waste Mgt.	4
	Micro 509 Microbiology	5	CE711 Biological Process Des.	4	CE 460 Prof. Aspects Eng'g	1
	GEC/TE		GEC/TE		GEC/TE	
subtotal		11		10		8
Note:	GEC	=	General Education Curriculum;			
	TE	=	Technical Elective			

Table 10: Sample Schedule for the Proposed Bachelor of Science in Environmental Engineering (leading to the BSEnE degree; 200 cr. hr.)

Year	Autumn	cr. hr.	Winter	cr. hr.	Spring	cr. hr.
Freshman	Math 151 Calc. & Anal. Geom.	5	Math 152 Calc. & Anal. Geom.	5	Math 153 Calc. & Anal. Geom.	5
	Chem 121 General Chemistry I	5	Chem 125 Chemistry for Engineers	4	Phys 131 Particles & Motion	5
	Eng'g 181 Intro. Engineering I	3	Eng'g 183 Intro. Engineering II	3	EnGraph 167 Programming	4
	Eng 100 Engineering Survey	1	Engl 110 First-Year English Composition	5	Econ 200 Principles of Microeconomics	5
subtotal		14		18		19
Sophomore	Math 254 Calc. & Anal. Geom.	5	Phys 133 Thermo. & Quantum Mech	5	Chem 231 Intro. Organic Chem.	3
	Phys 132 Electricity & Magnetism	5	ME 420 Strength of Materials	4	CE 405 Prob. & Statistics	5
	ME 410 Statics	4	Math 415 Ord. & Part. Diff. Eq.	4	ME 430 Dynamics	4
	GEC/TE	varies	GEC/TE	varies	ENE 511 Intro. Environmental Eng'g	3
subtotal		>14		>13		15
Junior	Chem. 221 Anal. Chem.	5	Chem 520 Phys. Chem.	3	Chem 521 Phys. Chem.	3
	ENE 413 Fluid Mechanics	4	CE 406 Numerical Methods	5	ENE 460 Prof. Aspects Eng'g	1
	ENE 540 Civil & Env. Eng'g Systems	4	ENE 516 Water Resources Eng'g	4	ENE 520 Treatment Plant Des.	4
	GEC/TE	vairies	Soil Sci 300	5	GEC/TE	varies
subtotal		>8		17		>8
Senior	ENE 610 Anal. Nat. & Pollut. Water	3	ENE 576 Eng. Plan. & Econ.	4	ENE 619 Capstone Des. Project	4
	Micro 509 Microbiology	5	ENE 620 Treat. Plant Des. Lab.	2	ENE 717 Solid Waste Mgt.	4
	GEC/TE	varies	ENE 711 Biol. Process Des.	4	ChBE 771 Air Pollution	3
	GEC/TE	varies	Chem 587 Anal Chem II	3	GEC/TE	varies

subtotal	>8	>10	>11
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Appendix C

Compliance with College of Engineering Core Curriculum Requirements

University General Education Requirements .

43 cr. hr.

ENGL 110	5	Composition
xyz 367	5	Second Writing Course
varies	3	Additional Writing Instruction in Regular Courses [Distributed as follows: CE 405 Observational Analysis (1); CE 406 Fundamentals of Civil Engineering Analysis (1); EnE 619 Environmental Engineering Capstone Design (1)]
ECON 200	5	Principles of Microeconomics
varies	5	Second Social Science Course
varies	5	History Course
varies	5	History Course
varies	5	Literature Course
varies	5	Visual or Performing Arts Course
ETHICS	5	Ethics (from an approved list, in lieu of either a social science or humanities (but not history) course

Central Core for All Engineering Majors .

42 cr. hr.

CHEM 121	5	General Chemistry
MATH 151	5	Calculus and Analytical Geometry
MATH 152	5	Calculus and Analytical Geometry
MATH 153	5	Calculus and Analytical Geometry
MATH 254	5	Calculus and Analytical Geometry
PHYS 131	5	Particles and Motion
PHYS 132	5	Electricity and Magnetism
ENG 100	1	Engineering Survey
ENG 181	3	Introduction to Engineering I
ENG 183	3	Introduction to Engineering II

College Required Additional Science:

at least one but not more than three topics from among (1) Biological Science, (2) Chemistry, (3) Earth and Geological Sciences, (4) Physics and (5) Advanced Chemistry (

two topics = 9 cr. hr.

CHEM 125	4	Chemistry for Engineers
PHYS 133	5	Thermal Physics, Waves and Quantum Mechanics

College Required Additional Mathematics and Statistics:

at least two topics but not more than four from among (1) Complex Variables, (2) Discrete Mathematics, (3) Linear Algebra, (4) Ordinary Differential Equations, (5) Numerical Methods, (6) Partial Differential Equations, (7) Probability and Statistics and (8) Vector Analysis

three topics = 12 cr. hr.; 1 cr. hr. in each of CE 405 and 406 counts as writing

CE 405	4(5)	Observational Analysis
CE 406	4(5)	Fundamentals of Civil Engineering Analysis
MATH 415	4	Ordinary and Partial Differential Equations

College Required General Engineering:

at least four topics from among (1) Engineer in Society, (2) Computer or Information Science, (3) Programming, (4) Statics, (5) Dynamics, (6) Strength of Materials, (7) Materials, (8) Engineering Economics, (9) Thermodynamics or Heat Transfer and (10) Electrical Topics

five topics = 20 cr. hr.

ENE 576	4	Civil and Environmental Engineering Economics and Planning
EG 167	4	Engineering Graphics II (CAD, Programming)
ME 410	4	Statics
ME 420	4	Strength of Materials
ME 430	4	Dynamics

Required Environmental Engineering Core .**67 cr. hr.; 1 cr. hr. in CE 619 counts as writing**

ENE 413	4	Fluid Mechanics
ENE 460	1	Professional Aspects of Civil and Environmental Engineering
ENE 511	3	Introduction to Environmental Engineering
ENE 516	4	Water Resources Engineering
ENE 520	4	Treatment Plant Design
ENE 540	4	Civil and Environmental Engineering Systems
ENE 610	3	Analysis of Natural and Polluted Water
ENE 619	3(4)	Environmental Engineering Capstone Design
ENE 620	2	Treatment Plant Design Laboratory
ENE 711	4	Biological Process for Used Water Treatment
ENE 717	4	Municipal and Industrial Solid Waste Management
CHBE 771	3	Air Pollution
CHEM 221	5	Analytical Chemistry I
CHEM 231	3	Introduction to Organic Chemistry (may substitute CHEM 251)
CHEM 520	3	Physical Chemistry
CHEM 521	4	Physical Chemistry (cont'd)
CHEM 587	3	Analytical Chemistry II: Instrumental Analysis
MICRO 509	5	Basic and Practical Microbiology
Soil Sci 300	5	Soil Science (both lecture and laboratory)

Pre-Approved Environmental Engineering Technical Electives**at least 8 cr. hr.**

ChBE 772	3	Principles of Sustainable Engineering
CE 554	4	Geotechnical Engineering
CE 694	4	Geoenvironmental Engineering
CHEM 251	3	Organic Chemistry (may be substituted for CHEM 231)
CHEM 252	3	Organic Chemistry
CHEM 253	3	Organic Chemistry
ENE 613	4	Applied Hydrology
ENE 618	4	Ecological Engineering and Science
ENE 714	3	Hazardous Waste Management
ENE 720	3	Environmental Engineering Risk Management
ENE 719	3	Water Quality Modeling
ENE 722	4	River and Open Channel Hydraulics
ENE 723	4	Transport Phenomena in Water Resources Engineering
ENE 750	4	Seepage in Permeable Materials
ENE 760	5	Civil and Environmental Engineering Planning
ENE 771	3	Radioactive Waste Management
ENE 693	1-5	Individual Studies

ENE 694	1-5	Group Studies
ENE 798	1	Current Topics in Environmental Science and Engineering
ENE H783	1-5	Honors Research
ENR 201	5	Introduction to Environmental Science
ENR 355	3	Water Quality
ENR 627	5	Ecology and Management of Aquatic Invertebrates
ENR 675	3	Fate of Pollutants in Soils and Natural Water
ENR 752	4	Environmental Science and Law
ENR 770	3	Watershed Ecology Restoration
ENTOM 694	2-5	Ecological Risk Assessment
ENTOM 762	5	Environmental Toxicology and Chemistry
FABE 652	4	Ecosystems for Waste Treatment
GEOL 651	5	Hydrogeology
GEOL 717	5	Containment and Remediation of Contaminants in Ground Water
GEOL 718	5	Geochemistry of Natural Waters
GEOL 719	5	Environmental Organic Geochemistry
GEOL 751	5	Quantitative Groundwater Flow Modeling
GEOL 752	5	Contaminant Hydrogeology
GEOL 754	5	Groundwater Risk Assessment
ISWE 757	3	Industrial Ecology: Production Systems Perspective
SS 680	5	Soil Chemistry

Appendix D

Course Change Requests

and

Course Syllabi

OHIO STATE COURSE CHANGE REQUEST

College: ENGINEERING

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Department: Civil and Environmental Engineering and Geodetic Science

Proposed effective Qtr/Yr: SU ___ AU x WI ___ SP ___ Year: 2008 (see OAA manual for deadlines)

A. **Course Offerings Bulletin Information.** Follow instructions in the *OAA Procedures Manual*. Before you fill out the "present Course" information, be sure to check the latest edition of the Course Offerings Bulletin and subsequent circulating forms. You may find that the changes you need have already been made or that additional changes are needed.

*If the course offered is less than quarter, term, or semester, complete the Flexibly Scheduled/Off Campus, Workshop Request form.

COMPLETE ALL ITEMS IN THIS COLUMN

Present Course

1. Book 3 listings: Civil Engineering
2. Number: See attachment
3. Full title: See attachment
4. 18-char. transcript title: See attachment
5. Level and credit hours: See attachment
6. Description (25 words or less): See attachment

7. Qtrs offered: See attachment SU ___ AU ___ WI ___ SP ___
8. Distribution of contact time: See attachment
9. Prerequisite(s): See attachment
10. Exclusion: _____
11. Repeatable to a maximum of _____ credits.
12. Off-Campus field experience: _____

13. Cross-listed with: _____
14. Check the curriculum requirement this course fulfills:
BER ___ LAR ___ GEC ___ 3rd writing course _____
15. Grade option (check): Ltr ___ SU ___ P ___
If P, what is the last course in the series? _____

16. Is an honors version of this course available? Y ___ N ___
17. Other general course information: _____

COMPLETE ONLY THOSE ITEMS THAT CHANGE
Changes Requested

- See Attachment
-
- No change
-
- See Attachment
-
- See Attachment
-
- No change
-
- See Attachment
-
- SU ___ AU ___ WI ___ SP ___ No change
1st SEM ___ 2nd SEM ___
-
- No Change
-
- See Attachment
-
- No Change
-
- Repeatable to a maximum of No change credits.
-
-
- Cross-listed with: See attachment
-
- Check the curricular requirement this course fulfills:
BER: ___ LAR: ___ GEC: ___ 3rd writing course: _____
- Grade option (check): Ltr: ___ S/U: ___ P: ___
- Last course in progress series: _____
Y ___ N ___
-

B. General Information

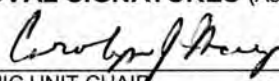
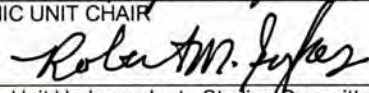
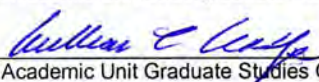
1. Do you want BRUTUS to enforce the prerequisites? (see OAA Procedures Manual for what BRUTUS can enforce) Yes No
2. Does this course currently satisfy any GEC requirements: Yes No
3. What other units require this course? See attachment
 Have these changes been discussed with those units? Yes No
4. Have these changes been discussed with academic units that might have a jurisdictional interest in the subject matter? Yes No
5. Is the request contingent upon other requests?(If so, list) Yes No

6. Purpose of the proposed change. (If it affects the content of the course, attach a revised syllabus and course objectives.) **New Degree Program**

7. Describe any changes in library, equipment or other teaching aids needed as a result of the proposed change.

None

8. If the change involves budgetary adjustments, describe the funding method. **None**

APPROVAL SIGNATURES (As needed, All signatures on lines in ALL CAPS (e.g. ACADEMIC UNIT) must be completed.)		
<input checked="" type="checkbox"/> 	CAROLYN J. MERRY	3/28/06
ACADEMIC UNIT CHAIR	printed name	date
<input checked="" type="checkbox"/> 	CHARLES A. MOORE	3/28/06
Academic Unit Undergraduate Studies Committee Chair (Undergraduate course)	printed name	date
	WILLIAM E. WOLFE	3/27/06
Academic Unit Graduate Studies Committee Chair (Undergrad/Grad course)	printed name	date
School/College Undergraduate Curriculum Committee (Undergrad/Grad course)	printed name	date
School/College Graduate Curriculum Committee (Undergrad/Grad course)	printed name	date
School Director (if appropriate)	printed name	date
COLLEGE DEAN	printed name	date
Graduate School (if appropriate)	printed name	date
ASC Curriculum Committee Chair (if appropriate)	printed name	date
University Honors Center (if appropriate)	printed name	date
Office of International Education (study tour only)	printed name	date
ACADEMIC AFFAIRS	printed name	date

ENVIRONMENTAL ENGINEERING COURSE CHANGES

Crse Num	Old Course Name	New Course Name (changes in Bold Italics)	Old Prefix	New Prefixes	Description (Changes in Bold Italics)	Prerequisite (Changes in Bold Italics)	Qtrs Offered (No Change)	Distribution of Contact Time (No Change)	Level and credit hours (No Change)	18-char. transcript title (Changes in Bold Italics)
413	Fluid Mechanics	No Change	CE	CE & ENE Cross Listed	Fluid properties; fluid statics; flow concepts; continuity, energy, and momentum equations; dimensional analysis and dynamic similarity; viscous effects; drag; basic pipe flow; lab demonstrations and experiments.	Civil Eng or Environmental Eng or Agr Eng major; minimum CPHR of 2.0; or written permission of dept chairperson.	Au.	3 cl, 1 2-hr lab.	U 4	FLUID MECHANICS
460	Professional Aspects of Civil and Environmental Engineering	No Change	CE	CE & ENE Cross Listed	Topics in civil and environmental engineering ethics and practice.	Civil or Environmental en major; must be taken as soon as possible upon entering the major. GEC course. This course is graded S/U.	Wi, Sp.	1 2-hr lab.	U 1	PROFNL ASPECTS
511	Introduction to Environmental Engineering	No Change	CE	ENE	Quantitative analysis of water, air, and noise pollution, hazardous waste management, ionizing radiation, occupational and environmental health engineering, and pollution prevention.	Chem 122 or 125, and Math 152; acceptance as an engineering or environmental science major or permission of instructor.	Sp.	3 cl.	U G 3	INTRO ENV ENGINEER
516	Water Resources Engineering	No Change	CE	CE & ENE Cross Listed	Pipe systems, introduction to open channel flow, basic hydrology, demographic studies, water supply, and wastewater flows.	413 and En Graph 200 or En Graph 167 and civil en or env en major.	Wi.	4 cl.	U G 4	WATER RESOURC ENGR
520	Design of Treatment Facilities	No Change	CE	CE & ENE Cross Listed	Selection and design of processes for the purification of natural and used waters.	Chem 122 or 125.	Sp.	4 cl.	U G 4	DSGN TREATMENT FAC
540	Civil Engineering Systems	Civil and Environmental Engineering Systems	CE	CE & ENE Cross Listed	Basic concepts and methods of systems engineering and applications to civil engineering problems in transportation and water resources planning.	405	Au.	4 cl.	U G 4	CIV ENE ENGR SYS

ENVIRONMENTAL ENGINEERING COURSE CHANGES

Crse Num	Old Course Name	New Course Name (changes in Bold Italics)	Old Prefix	New Prefixes	Description (Changes in Bold Italics)	Prerequisite (Changes in Bold Italics)	Qtrs Offered (No Change)	Distribution of Contact Time (No Change)	Level and credit hours (No Change)	18-char. transcript title (Changes in Bold Italics)
576	Civil Engineering Economics and Planning	Civil and Environmental Engineering Economics and Planning	CE	CE & ENE Cross Listed	structural design, and construction management.	406	Wi	4 cl.	U G 4	CE ENE ECON PLAN
590.04	Environmental Engineering Process Development	No change	CE	ENE	Topics of special interest in environmental engineering process design	Junior Standing in Engineering	Au, Wi, Sp	No change	U 2	ENV ENG PROCESS
610	Analysis of Natural and Polluted Waters	No Change	CE	ENE	A laboratory study of the measurement and interpretation of water quality indices and pollution parameters including BOD, COD, alkalinity, nutrients, PH, and heavy metals.	Chem 122 or 125 and Math 152 or equiv.	Au	2 cl, 1 3-hr lab.	U G 3	NAT & POLLUTED WATR
613	Applied Hydrology	No Change	CE	CE & ENE Cross Listed	Hydrologic cycle, meteorology, streamflow, evapotranspiration, hydrographs, runoff relations, runoff hydrographs, groundwater, unit hydrographs, flood routing, frequency and duration studies, and application of hydrologic techniques.	510 or 516.	Au	4 cl.	U G 4	APPLIED HYDROLOGY
618	Ecological Engineering	No Change	CE & F&B & SNR Cross Listed	ENE & F&B & SNR Cross Listed	Definition, classification, and practice of Ecological Engineering. Course describes ecological systems and the design of natural systems to provide societal services and benefits to nature.	Jr standing with at least one course in one of the following subject areas: biology, ecology, engineering, or geology. Not open to students with credit for FA&B Eng 618 or Nat Res 618. Cross-listed in Food, Agricultural and Biological Engineering, and Natural Resources.	Wi	2 2-hr cl.	U G 4	ECOL ENGR & SCI
619	Environmental	No Change	CE	ENE	Experimental and design	460, 516, 520, 576 and sr	Sp	2 cl, 2 2-hr	U G 4	ENV ENG CAPSTN

ENVIRONMENTAL ENGINEERING COURSE CHANGES

Crse Num	Old Course Name	New Course Name (changes in Bold Italics)	Old Prefix	New Prefixes	Description (Changes in Bold Italics)	Prerequisite (Changes in Bold Italics)	Qtrs Offered (No Change)	Distribution of Contact Time (No Change)	Level and credit hours (No Change)	18-char. transcript title (Changes in Bold Italics)
	Engineering Capstone Design							labs.		DSN
620	Treatment Plant Design Laboratory	No Change	CE	ENE	laboratory for water supply collection, transmission, distribution and measurement systems, sewage and storm water collection, and disposal and measurement systems. A laboratory demonstration of the treatment processes discussed in 520 and an introduction to pilot-testing procedures for environmental engineering majors.	standing in environmental eng. Must be taken as close to graduation as possible. Not open to students with credit for 519. Third writing course. 610; prereq or concur: 520.	Wi	1 cl, 1 3-hr lab.	U G 2	TREATMENT PLNT LAB
624	Coastal and Ocean Engineering	No Change	CE	CE & ENE Cross Listed	Linear and nonlinear waves, water level and wave forecasting spectra, forces on fixed structures; beach processes, littoral drift, and transport; shoreline protection.	516.	Wi	4 cl.	U G 4	COASTL & OCEAN ENG
640	Civil and Environmental Systems Engineering	No Change	CE	CE & ENE Cross Listed	Critical path method; linear, integer, and nonlinear programming simulation; mathematical modeling and optimization with design applications in civil and environmental engineering; research paper.	Permission of instructor. Not open to students with credit for 540	Au	4 cl.	U G 4	
711	Biological Processes for used Water Treatment	Bioremediation of Used Waters	CE	ENE	Principles and design of biological processes for used water treatment.	520 or equiv.	Wi	4 cl.	U G 4	BIOL PRCS USD WTR
713	Water Quality and Environmental Measurement	No Change	CE	ENE	The application of advanced physical and chemical measurement and calculation techniques to environmental engineering problems.	610 or permission of instructor	Wi	4 cl.	U G 4	WATER&ENVIRON MEAS
714	Hazardous Waste Management	No change	CE	ENE	Environmental Regulations; site remediation process;	520	Sp	3 cl.	U G 3	HAZRDOUS WASTE MG

ENVIRONMENTAL ENGINEERING COURSE CHANGES

Crse Num	Old Course Name	New Course Name (changes in Bold Italics)	Old Prefix	New Prefixes	Description (Changes in Bold Italics)	Prerequisite (Changes in Bold Italics)	Qtrs Offered (No Change)	Distribution of Contact Time (No Change)	Level and credit hours (No Change)	18-char. transcript title (Changes in Bold Italics)
715	Water Resources Systems: Water Supply	No Change	CE	ENE	remedial alternatives; implementation; case studies. Regional and municipal water supply design and management: water use, law, demand, pricing, supply alternatives, and allocation; and optimal system and component design.	516 and 540	Sp	5 cl.	U G 5	WATER RES SYS-SPLY
717	Municipal and Industrial Solids Waste Management	No Change	CE	ENE	Characterization and sources of solid wastes; solid waste management; collection systems; processing; disposal; and recycle.	Prereq or concur: 520.	Sp	4 cl.	U G 4	MUNI&INDUS SLD WST
718	Strategies for Industrial Environmental Management	No change	CE	ENE	Industrial environmental management systems, audits, accounting, reports; industrial ecology; design for environment; ISO 900, 14000, global competition; entrepreneurship; case studies.	540 or equiv. with permission of instructor.	Au	1 3-hr cl.	U G 3	STRAT IND ENV MGT
719	Water Quality Modeling	No change	CE	ENE	Stream and effluent standards for beneficial uses, and computer modeling of pollutant impacts on river.	520 or equiv. with permission of instructor.	Au	3 cls.	U G 3	WATRQUALTY MODLING
720	Environmental Engineering Risk Assessment	No Change	CE	ENE	Basic methodologies for quantitative risk assessment and application to a variety of contaminants, pathways, and engineering problem areas.	540 or grad standing.	Wi	3 Cls.	U G 3	ENV ENG RISK ASMNT
722	River and Open Channel Hydraulics	No Change	CE	CE & ENE Cross Listed	Flow Classifications, channel properties, energy and momentum, principals, critical flow, uniform, flow formulas, erodible and	516	Sp	4 cls.	U G 4	OPEN CHANIL HYDRCLS

ENVIRONMENTAL ENGINEERING COURSE CHANGES

Crse Num	Old Course Name	New Course Name (changes in Bold Italics)	Old Prefix	New Prefixes	Description (Changes in Bold Italics)	Prerequisite (Changes in Bold Italics)	Qtrs Offered (No Change)	Distribution of Contact Time (No Change)	Level and credit hours (No Change)	18-char. transcript title (Changes in Bold Italics)
723	Transport Phenomena in Water Resources Engineering	No Change	CE	CE & ENE Cross Listed	nonerodible and channel design, and gradually varied flow profile computation. Water environment momentum mass energy transport, laminar and turbulent mixing; applications include river and lake pollutant dispersal, heated effluent plumes, eutrophication processes.	516 and Math 255 or 415, or equivs. Not open to students with credit for 614.	Au	4 cl.	U G 4	TRANSPRT PHENOMENA
760	Civil and Environmental Engineering Planning	No Change	CE	CE & ENE Cross Listed	Water resource planning process, benefit-cost analysis; environmental economics, and social impacts of civil engineering projects; project selection; and case studies in water resources, transportation and energy.	516.	Sp	5 cl.	U G 5	CIV&ENVMTL ENG PLN
771	Radioactive Waste Management	No Change	CE	ENE & NUJE Cross Listed	Overview of radioactive waste management. Covers waste categories sources, treatment and disposal methods, minimization, transportation and current research topics.	Nuclr En 505 or Nuclr En 606 or permission of instructor	Au	3 cl.	U G 3	RADIOACT WASTE MGT
797	Interdepartmental Seminars	No Change	CE	CE & ENE Cross Listed	Two or more departments may collaborate in presenting seminars in subjects of mutual interest; topics to be announced.		Sp. Repeatable		U G 1-5	INTERDEPTL SEMINAR
798	Current Topics in Environmental Science and Engineering	No Change	CE	ENE	Seminar course which presents current research findings on environmental quality and pollution control.	Grad standing in engineer science, nat res, or agr, or permission of instructor. Not available for simultaneous credit as Nat. Res 798 Repeatable to a maximum of 3 cr hrs.	Au, Sp.	1 cl.	U G 1	CURR TOPX ENV SCI

CE/ENE 413 Fluid Mechanics**Catalog Description:**

Fluid properties; fluid statics; flow concepts; continuity, energy, and momentum equations; dimensional analysis and similarity; viscous effects; and basic pipe flow

Required or Elective: Required

Lecture/Laboratory Schedule: 3 hours lecture; 2 hour recitation/lab session

Credit Hours (and quarter(s) offered): 4(Fall)

Prerequisite(s): EM 410 or 430(concurrently registered), CE 405 or standing as an Agricultural Engineering Major; a CPHR of 2.0 or written permission

Textbook(s) and/or Other Required Material:

Fluid Mechanics 9th ed., V. Streeter, E. Wylie, and K. Bedford, 1998, McGraw Hill Co. NY.
Videos, Lab Notes, Problem Set and Test Solutions etc. <http://hagl.ohio-state.edu/~ce413/>

Course Objectives (and program outcomes addressed):

1. Students will be skilled in identifying, and determining various fluid properties and demonstrating their proper use in engineering calculations (a, k)
2. Students will be skilled in the differences between normal and shear stresses and the prediction of pressure distributions in static fluid conditions (a, k)
3. Students will be skilled in the calculation of forces on objects undergoing constant or no acceleration (a, e, k)
4. Students will be skilled in methods for characterizing arbitrary fluid motions and their use in deriving the basic control volume equations of conservation of mass, momentum and energy (a, k)
5. Students will be skilled in applying the basic control volume approaches to elementary civil, environmental, geological, and agricultural engineering problems (a, b, d, e, k)
6. Students will be skilled in methods for characterizing viscous friction in pipes and their use in pipe flow solutions for elementary engineering problems (a, d, e, k).

Topics Covered (and approximate time distribution):

1. Fluid properties (1 week)
 - density, specific weight, specific gravity, temperature, ideal gas constant
 - bulk modulus of elasticity
 - surface tension, hoop stress
 - capillary rise and depression
2. Stress in fluids (.33 week)
 - Definition of scalar, vector, and tensor
 - Definition of force and stress at a point on an arbitrary surface
 - Definition of tangential and normal stress at an arbitrary point
 - Definition of shear and normal stress in stress tensor
 - Definition of pressure
3. Pressure distributions (1 week)
 - Definition of static fluid
 - Derivation of hydrostatic pressure distribution in fluids
 - Derivation of other simple pressure distributions for gases

4. Forces on objects placed in no or constant acceleration flows (2 weeks)
 - Forces on plane surfaces by the Center of Pressure Method
 - Forces on plane surfaces by the Pressure Prism Method
 - Forces curved surfaces
 - Relative acceleration and force distributions
5. Concepts for characterizing moving fluids (0.67 week)
 - Laminar and turbulent flow
 - 1, 2, and 3 dimensional flow
 - Streamlines, streaklines, pathlines, and rays
 - boundary layers and free stream flows
6. Basic Control volume conservation equations (1.5 week)
 - Reynolds Transport Theorem for a Control Volume
 - Conservation of mass
 - Conservation of Energy and the First and Second Law of Thermodynamics
 - Newton's Second Law for a Control Volume
7. Engineering applications of governing equations (2.5 weeks)
 - Mass
 - Mass and energy
 - Combined mass, momentum, and energy
8. Viscous pipe flow and engineering applications (1 week)
 - Head loss in pipes
 - Laminar flow
 - Turbulent flow and pipe roughness
 - Manning's friction factor
 - Moody Diagram and the Colebrook Equation
 - Engineering applications

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	0
Basic Sciences	1
Engineering Topics	3
General Education:	0

Grading Plan:

Homework:	10%
Project	10%
Midterms (2)	50%
Final	30%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 1

Relationship of Course to Program Outcomes (a)-(k):

Program Outcomes Addressed: a, b, d, e, and k

Faculty Member Preparing Description: Keith W. Bedford 5/10/2005

CE/ENE 460: Professional Aspects of Civil and Environmental Engineering

Catalog Description: Topics in civil and environmental engineering ethics and practice.

Required or Elective: Required

Lecture/Laboratory Schedule: 1 2-hour lab

Credit Hours (and quarter(s) offered): 1 (Winter, Spring)

Prerequisite(s): Civil engineering major; must be taken as soon as possible upon entering major. GEC course. This course is graded S/U.

Textbook(s) and/or Other Required Material:

Handouts are used extensively; additional readings are on Closed Reserve, Engineering and Science Library.

Course Objectives (and program outcomes addressed):

1. Students will be well informed on major option areas, advising procedures, how to find an engineering job, undergraduate professional organizations, university Minor programs, and graduate school opportunities (f, i).
2. Students will recognize the importance of professional licensure by taking the FE Exam in their Senior year. Students will be familiar with exam coverage and OSU-CE results (f, i).
3. Students will be aware of general guidance given by the profession on a wide range of topics in engineering ethics (f, g, j).
4. Students will be familiar with terminology used and general guidance given by the profession on a wide range of professional practice topics (f, g, j).

Topics:

Introduction; term paper topics and reference sources;

Major Options in CEE, technical advisors; deadlines; graduate school, graduate assistantships; job search; ECS services; FE Exam coverage, OSU-CEE results; ethics diagnostic exam; NCEES Model Rules, and ASCE Code of Ethics (2 weeks).

FE review questions (definition of a profession/ethics; codes of ethics; enforcement; ethical priorities; whistleblowing; civic affairs and public policy; sustainable development; environmental ethics; environmental impact statements; competency; ASCE Policy 465; body of knowledge; role of project coordinator; plan stamping; public comment by an engineer; conflict of interest; service on advisory boards; multiple clients on same project; receiving gifts; confidentiality; patents; moonlighting; duty to firm; political donations; competitive bidding; charging for services; resume/qualifications padding; advertising; criticism of other engineers; activity outside of work; professional development; liability; practice in a foreign country, and; dealing with suppliers) (4 weeks).

Alumni Ethics Survey results; Engineering Career Services data on OSU-CEE department and graduates; diversity issues; qualifications-based-selection (QBS); competitive bidding for construction contracts; charging for services; project delivery systems; salary and grade descriptions, and; employment intangibles (2 weeks).

Course duration is 8 weeks, not 10.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics:

Basic Sciences:

Engineering Topics: 1
General Education:

Grading Plan (S/U):

Attendance:	10%
Ethics Paper	30%
Final	60%

Relationship of Course to Program Objectives

Environmental Engineering Program Objectives (1-5) Addressed:3, 4, 5

Relationship of Course to Program Outcomes (a-k):f, g, i, j

Prepared by: Earl Whitlatch **Date:** 4/9/05

ENE 511: Introduction to Environmental Engineering**Catalog Description:**

Quantitative analysis of water, air, and noise pollution, hazardous waste management, ionizing radiation, occupational and environmental health engineering, and pollution prevention.

Required or Elective: Required

Lecture/Laboratory Schedule: 3 1-hr lectures

Credit Hours (and quarter(s) offered): 3 (Spring)

Prerequisite(s): Chem 122 and 125, or equivalent

Textbook(s) and/or Other Required Material:

Principles of Environmental Engineering and Science, Mackenzie L. Davis and Susan J. Masten (McGraw-Hill, NY: 2004).

Course Objectives (and program outcomes addressed):

1. Students will be skilled in the derivation and use of mass and energy balance equations to describe pollutant behavior in air, land and water systems.
2. Students will have quantitative and qualitative skills in the management of water quality.
3. Students will have both qualitative and quantitative knowledge of the sources, fate, effects and control of air pollution, noise pollution, hazardous waste and radioactive waste.
4. Students will have qualitative knowledge of risk assessment, environmental regulations, occupational and environmental health, pollution prevention and sustainability.
5. Students will demonstrate knowledge of environmental engineering problems that are of great contemporary concern.

Topics Covered (and approximate time distribution):

Environmental Systems (0.5 weeks)
 Environmental Legislation and Regulations (0.5 weeks)
 Risk Assessment and Management (0.5 weeks)
 Mass and Energy Balances (0.5 weeks)
 Water Quality Management (1.5 weeks)
 Rivers - DO, BOD, DO Sag
 Lakes - Phosphorus
 Estuaries, Marine and Ground Water
 Air Pollution (1.5 weeks)
 Fundamentals and Effects
 Origin and Fate
 Indoor Air Pollution
 Meteorology and Dispersion Modeling
 Control
 Hazardous Waste Management (1.5 week)
 Risk, RCRA and HSWA
 CERCLA, SARA and Management
 Treatment, Disposal & Ground Water Contamination
 Environmental Health Engineering (1.5 weeks)

Properties, Effects and Control of Noise Pollution
 Occupational and Environmental Health
 Ionizing Radiation (1.0 week)
 Fundamentals
 Effects, Standards and Exposure
 Protection and Waste
 Pollution Prevention (0.5 weeks)
 Waste Minimization, Engineering Sustainability and Resilience
 Contemporary Issues in Environmental Science and Engineering (0.5 weeks)

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	
Basic Sciences	1
Engineering Topics	2
General Education:	

Grading Plan:

Homework	20%
Quizzes (4 to 5)	40%
Final Examination	20%
Research Project	20%

Relationship of Course to ABET Program Outcomes (a-k):

Program Outcomes Addressed: a, b, c, e, f, g, h, i, j, k

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 1, 2, 3, 4, 5

Faculty Member Preparing Description: John J. Lenhart 4/15/05

CE/ENE 516 Water Resources Engineering**Catalogue Description:**

Pipe systems, introduction to open channel flow, basic hydrology, demographic studies, water supply, and wastewater flows

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): CE 413 and En Graph 200 or 167 and civil en major.

Textbook(s) and/or Other Required Material:

D. A. Chin, *Water Resources Engineering*, 2nd ed., Prentice Hall, Upper Saddle River [NJ]

Course Objectives:

To acquire a broad understanding of the principles of water resources engineering within the field of civil engineering by introducing the students to the fields of closed conduit hydraulics, open channel hydraulics, surface water hydrology, and groundwater hydrology.

Topics Covered

1. Population Projections,
2. Water Use and Sewage Flows (6 classes)
3. Project Economics (4 classes)
4. Closed conduit flow (10 classes)
5. Pumps (2 classes)
6. Open-channel flow (4 classes)
7. Hydrology (8 classes)
8. Water supply systems (2 classes)
9. Wastewater systems (2 classes)

Distribution of Hours:

Mathematics:	none
Basic Sciences:	20%
Engineering Topics:	80%
General Education:	none

Grading Plan:

Homework and Labs	20%
Midterm Examinations (3)	55%
Final Examinations	25%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, k

Environmental Engineering Program Objectives Addressed: 1, 2

Faculty Member Preparing Description:

Robert M. Sykes

Date: May 2, 1999

CE/ENE 520: Design of Treatment Facilities**Catalog Description:**

Selection and Design of Processes for the purification of natural and used waters

Required or Elective: Required

Lecture/Laboratory Schedule: 4 cl hrs

Credit Hours (and quarter(s) offered): 4 (Spring)

Prerequisite(s): Chem 122 or 125

Textbook(s) and/or Other Required Material:

R. L. Droste (1997), *Theory and Practice of Water and Wastewater Treatment*, Wiley & Sons, NY

Course Objectives (and program outcomes addressed):

Students will understand the basic theory and design of common water and wastewater treatment processes (a, c, e, k)

Topics Covered (and approximate time distribution):

Historical perspective of water treatment, 1 cl hr
 Unit Operations and Plant Layout Diagrams, 1 cl hr
 Water use and standards, 1 cl hrs
 Disinfection Processes Overview, 1 cl hrs
 Chlorine Chemistry, 1 cl hr
 Chlorination Kinetics, 1 cl hr
 CT Concept and Chlorinator Design, 1 cl hr
 Design of UV Systems, 1 cl hr
 Rapid Sand Filter Design, 2 cl hrs
 Headloss in filters, 1 cl hr
 Filter Backwash Calculations, 1 cl hr
 Membrane processes, 2 cl hr
 Jar Testing and Chemical Feed, 1 cl hr
 Coagulation and Flocculation Design, 3 cl hrs
 Column Settling Tests, 1 cl hr
 Sedimentation Tank Design, 2 cl hours
 Softening, 2 cl hrs
 Ion Exchange Processes, 1 cl hr
 Activated Carbon, 2 cl hrs
 Activated Alumina, 1 cl hr
 Plant Construction Cost Estimation, 1 cl hr
 Corrosion, 1 cl hr
 Wastewater Constituents, 1 cl hr
 Activated Sludge Processes, 2 cl hrs
 Trickling Filters, 2 cl hrs
 Anaerobic Biological Processes, 3 cl hrs
 Management of biosolids, 1 cl hr

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	10%
Engineering Topics	80%
General Education:	10%

Grading Plan:

Homework	10%
Midterm Examinations	45%
Final Examination	25%
Design Project	20%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 1, 2, 4

Relationship of Course to Program Outcomes (a-k):

ABET Program Outcomes Addressed: a, c, e, k

Faculty Member Preparing Description: Harold W. Walker, April 19, 2005

CE/ENE 540 Civil and Environmental Engineering Systems

Catalog Description:

Basic concepts and methods of systems engineering and applications to civil engineering problems in transportation and water resources planning, structural design, and construction management.

Required or Elective: Required

Lecture/Laboratory Schedule: 4 hours lecture

Credit Hours (and quarter(s) offered): 4 (Autumn)

Prerequisite(s): CE 405

Textbook(s) and/or Other Required Material:

ReVelle, Charles S., Whitlatch, E. Earl, and Jeff R. Wright, *Civil and Environmental Systems Engineering*, 2nd. Ed. (Upper Saddle River, NJ: Prentice Hall, Inc., 2004), 552 pp.

Whitlatch, E. Earl, Course Notes, available for purchase at Cop-Ez (Tuttle Garage outlet)

Course Objectives (and program outcomes addressed):

1. Students are proficient in the basic methods used for activity scheduling and project management on design and construction projects (c, e, k).
2. Students are skilled in the identification and statement of objectives and constraints found in simple engineering design and project planning situations, and are able to write and solve a variety of mathematical programming models for engineering systems analysis (a, c, e, k).

Topics Covered (and approximate time distribution):

Scheduling Models: Critical Path Method (4 weeks):

Arrow diagram; critical path; cost-duration curves, project compression; activity schedule; float times; bar charts; resource leveling; progress curve; simulation of empirical distributions; Program Evaluation and Review Technique (PERT); MS PROJECT software package.

Systems Analysis, Word Models, Simple Linear Programming Models (3 weeks):

History, definitions, mathematical programming, word models, simple linear models, graphical solutions and their characteristics, sensitivity analysis, dual variables, intermediate-level LP models, basics and rationale for Simplex algorithm, standard LP form, standard equality LP form, LINDO software package.

Integer Programming (IP) and IP Models (1 week):

General, mixed, and (0,1) IP models, transportation and assignment problems, integer friendly and unfriendly models, LINDO software package, basics of the branch-and-bound solution procedure.

Decision Theory (1 week):

Risk and uncertainty, simple decision tree, utility considerations, general decision tree, calculation of probabilities, foundation design example, expected monetary

value of information (EMVI), expected monetary value of perfect information (EMVPI).

Nonlinear Programming (NLP) and NLP Models (1 week):

Lagrange multipliers, simple NLP models, concrete beam design example, meaning of Lagrange multipliers.

Grading Plan:

Homework	20%
Midterms (2)	50%
Final Exam	30%

Distribution of Hours Toward Meeting the Professional Component:

Mathematics 1
Basic Sciences
Engineering Topics 3
General Education:

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1, 2
Environmental Engineering Program Objectives (1-6) Addressed: 1, 2

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a, c, e, k

Faculty Member Preparing Description: Earl Whitlatch 4/10/05

CE/ENE 576 Civil and Environmental Engineering Economics and Planning

Catalog Description: Engineering economics and theories of planning applied to private and public civil works.

Required or Elective: Required

Lecture/Laboratory Schedule: 4 hours lecture

Credit Hours (and quarter(s) offered): 4 (Winter)

Prerequisite(s): Prereq. or coreq.: CE 406

Textbook(s) and/or Other Required Material:

ReVelle, Charles S., Whitlatch, E. Earl, and Jeff R. Wright, *Civil and Environmental Systems Engineering*, 2nd. Ed. (Upper Saddle River, N. J.: Prentice Hall, Inc., 2004), 552 pp., and; Whitlatch, E. Earl, Course Notes, available for purchase at Cop-Ez, (Tuttle Garage outlet)

Course Objectives (and program outcomes addressed):

1. Students will be skilled in the mathematics of compound interest (a, c, e).
2. Students will be able to choose the best alternative from a small set of mutually exclusive alternatives, based upon economic principles (a, c, e).
3. Students will have quantitative skills in the fundamental business and personal finance topics of depreciation, taxes, and inflation (a, c, e, i, j).
4. Students will have both qualitative and quantitative knowledge in such personal finance topics as home mortgages and affordability, asset and portfolio allocation, stocks, bonds, and retirement accounts (a, i, j).

Topics Covered (and approximate time distribution):

Interest and Equivalence (4 weeks)

Cash Flow Table, Cash Flow Diagram
 Simple Interest, Compound Interest
 Present Worth, Future Worth, Equivalence, Rule of 72
 Nominal Interest, Effective Interest
 Single Payment, Continuous Compounding
 Uniform Series, Arithmetic Gradient Series
 Geometric Gradient Series
 Uniform Series: Continuous Compounding
 Capitalized Cost
 Rate Survey and Concepts

Choice Between Alternatives (3 weeks)

Basic Concepts: Maximization of Net Benefits
 Sunk Cost, Opportunity Cost
 Present Worth Analysis
 Annual Cash Flow Analysis
 Incremental Benefit-Cost Ratio Analysis
 Incremental Rate of Return Method
 Minimum Attractive Rate of Return
 Payback Period
 Breakeven Analysis, Breakeven Chart

Public Investment
 Present Worth of Net Benefit, Benefit-Cost Ratio
 Social Rate of Discount and Influence on Project Economics
 Depreciation, Taxes, Inflation, and Personal Financial Planning (3 weeks)
 Depreciation
 Book Value
 Straight Line Depreciation
 Sum-of-the-Years'-Digits Depreciation
 Declining Balance Depreciation
 Modified Accelerated Cost Recovery System
 Other Property and Depreciation Methods
 Amortization and Depletion
 Taxes: Individual Income Tax, Corporate Income Tax
 Combined Incremental Tax Rate
 Before-Tax and After-Tax Rate of Return
 Inflation: CPI Historical, Construction Cost Indices
 Real and Nominal Rate of Return
 Personal Financial Planning
 Mortgage Interest and Principal Payments
 Retirement Accounts
 Stocks, Bonds, Portfolio Allocation

Distribution of Hours Toward Meeting the Professional Component:

Mathematics:
 Basic Sciences: 1
 Engineering Topics: 3
 General Education:

Grading Plan:

Homework 20%
 Midterms (2) 50%
 Final Exam 30%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 1, 2, 3, 5

Relationship of Course to Program Outcomes (a-k):

ABET Program Outcomes: a, c, e, i, j

Faculty Member Preparing Description: Earl Whitlatch 4/6/05

ENE 590: Environmental Engineering Process Development**Catalog Description:**

Topics of special interest in environmental engineering process design. Studies in the analysis, design, test, scale-up, fabrication and construction of environmental engineering processes.

Required or Elective: Elective

Lecture/Laboratory Schedule: 1 cl hr; 1 lab hr (arranged)

Credit Hours (and quarter(s) offered): UG 2 (A/W/S)

Prerequisite(s): Junior Standing in Engineering

Textbook(s) and/or Other Required Material: None

Course Objectives (and program outcomes addressed):

1. Students will develop a hands-on understanding of the design, construction and operation of a treatment process (a, b, c, e, k)
2. Students will be proficient in writing a formal design report and making presentations (c, g)
3. Students will develop knowledge of the impact of engineering solutions in a global, economic, environmental and societal context (h)

Topics Covered (and approximate time distribution): As part of this course, students compete in the Waste Management and Education Research Consortium (WERC) Environmental Design Contest, held annually in Las Cruces, New Mexico. Topics covered include:

- Design of Experiments (10%)
- Analysis of Experimental Results (10%)
- Presentation of Results in Written, Oral and Poster Form (10%)
- Unit Operation Design and Scale-Up (20%)
- Pilot-Plant Fabrication (20%)
- Organization and Teamwork (10%)
- Cost Assessment (10%)
- Pollution Prevention and Sustainability (10%)

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	10%
Basic Sciences	15%
Engineering Topics	60%
General Education:	15%

Grading Plan (S/U):

Group Project Rept	90%
Group Participation	10%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1, 2, 4

Environmental Engineering Program Objectives (1-6) Addressed: 1, 2, 4

Relationship of Course to Program Outcomes (a)-(k):

Program Outcomes Addressed: a, b, c, e, g, k

Faculty Member Preparing Description:Harold W. Walker

Date: April 19, 2005

ENE 610 Analysis of Natural and Polluted Water**Catalog Description:**

A laboratory study of the measurement and interpretation of water quality indicators and pollution parameters including pH, alkalinity, hardness, and BOD.

Required or Elective: Required

Lecture/Laboratory Schedule: 2 1-hr lectures, 1 3-hr lab

Credit Hours (and quarter(s) offered): 3 (Fall)

Prerequisite(s): Chem 121, and 122 or 125, or equivalent

Textbook(s) and/or Other Required Material:

A Problem-Solving Approach to Aquatic Chemistry, James N. Jensen (John Wiley & Sons, NY: 2003).
CE610 Laboratory Manual (Available for purchase in COP-EZ in Tuttle Parking Structure).
National Brand™ Laboratory Research Notebook, Catalog No. 77644 (blue without carbon paper) with left hand binding.

Course Objectives (and program outcomes addressed):

1. Students will be skilled in the laboratory measurement of water quality parameters.
2. Students will be able to quantitatively estimate the dominant chemical species in a given water sample.
3. Students will be skilled in the use of graphical solution techniques to determine the composition of a given sample of water.
4. Students will be skilled in the preparation and maintenance of a laboratory notebook.
5. Students will be able to explain measured changes in water composition based upon fundamental chemical and physical processes.

Topics Covered (and approximate time distribution):

Water Quality Parameters and Concentration Units (0.5 weeks)
Thermodynamics and Equilibrium (1.5 weeks)
Temperature, pH and I effects,
Working with Equilibrium Expressions (1.5 weeks)
Exact Solutions to Equilibrium Problems
Graphical Solutions (2 weeks)
Monoprotic Acid/Base
Polyprotic Acid/Base
Carbonate System
Homogeneous Processes (2.5 weeks)
Titrations and Buffers
Alkalinity and Acidity
Complex Formation
Oxidation and Reduction
Heterogeneous Processes (2 weeks)
Gas-Liquid Equilibria
Solid-Liquid Equilibria
Adsorption

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	0
Basic Sciences	2
Engineering Topics	1
General Education	0

Grading Plan:

Homework:	15%
Examinations (3)	45%
Laboratory Reports & Quizes	20%
Final Laboratory Project	20%

Relationship to ABET Outcomes (a-k): a, b, c, d, e, f, g, j, k

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1, 2, 4, 5

Environmental Engineering Program Objectives (1-5) Addressed: 1, 2, 4, 5

Faculty Member Preparing Description: John Lenhart 4/11/05

CE/ENE 613: Applied Hydrology**Catalog Description:**

Hydrologic cycle, meteorology, streamflow, evapotranspiration, hydrographs, runoff relations, runoff hydrographs, groundwater, unit hydrographs, flood routing, frequency and duration studies, and applications of hydrologic techniques

Required or Elective: Elective

Lecture/Laboratory Schedule: 4 hours lecture

Credit Hours (and quarter(s) offered): 4 (fall)

Prerequisite(s): CE 510 or 516

Textbook(s) and/or Other Required Material:

Hydrologic Analysis and Design, 3rd ed., Richard H. McCuen, Prentice Hall, NJ.

Course Objectives (and program outcomes addressed):

1. Students will be skilled in methods for delineating watershed boundaries, DEM databases, and quantitative methods for summarizing watershed length, network structure, bifurcation ratios, elevation changes, and slopes (a, e, k)
2. Students will be skilled in meteorologic sources of precipitation, methods for measurement and data analysis, and summary of these precipitation data into design storms (a, e, k)
3. Students will be skilled in methods for measuring streamflow and analyzing these data for peak and extreme value forms for use in engineering calculations (a, e, k)
4. Students will be skilled in methods for predicting piezometric head and subsurface groundwater velocity for steady and transient conditions (a, e, k)
5. Students will be skilled in the various forms of predicting and measuring evaporation and evapotranspiration as a function of windspeed and other climatological variables
6. Students will be skilled in methods for predicting infiltration (a, e, k)
7. Students will be skilled in methods for creating hydrographs and unit hydrographs as well as methods for separating out baseflow and interception (a, e, k)

Topics Covered (and approximate time distribution):

1. Statistics review (**0.5 weeks**)
 - t- tests
 - standard error
 - distributions
2. Watersheds (**1.0 weeks**)
 - geometric characterizations
 - time of concentration
 - sheet flow/channel flow definitions

3. Precipitation (1.0 weeks)

- meteorology/climate
- origins and characterization of precipitation
- intensity, duration, and frequency
- gaging networks, missing data, and data analysis
- design storms

4. Streamflow (1.5 weeks)

- measurement
- stream gage networks, data assimilation and analysis
- peak discharge, direct and indirect methods
- missing records

5. Frequency Analysis (1.0 weeks)**6. Groundwater (1weeks)**

- piezometric head
- Darcy steady state exact solutions
- time varying solutions
- safe yield

7. Evaporation (1.0 weeks)

- Hornbeck, Dalton, and Thornthwaite methods
- Evapotranspiration

8. Infiltration (1.0 weeks)

- Phi Index
- Horton's Method
- Green Amp Procedure

9. Hydrographs (2.0 weeks)

- definition of hydrographs and unit hydrographs
- synthetic and average hydrographs
- gamma function unit hydrographs

Distribution of Hours Toward Meeting the Professional Component:

Mathematics:

Basic Sciences:

Engineering Topics:4

General Education:

Grading Plan:

Homework	10%
Labs	10%
Midterms	50%
Final Exam	30%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1, 4

Environmental Engineering Program Objectives (1-5) Addressed: 1, 4

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a, e, k

Faculty Member Preparing Description: Keith W. Bedford **Date:** 5/10/2005

ENE/FABE/SENR 618 Ecological Engineering and Science

Catalog Description:

Definition, classification, and practice of Ecological Engineering. Course describes ecological systems and the design of natural systems to provide societal systems and benefits to nature.

Credit hours: U4

Lecture/Laboratory schedule: 2 2-hr cl.s

Offered: Winter quarter

Prerequisites: Jr. standing with at least one course in one of the following subject areas: biology, ecology, engineering, or geology. Not open to students with credit for FABE 618 or Nat Res 618. Cross-listed in Food, Agriculture and Biological Engineering and Environment and Natural Resources.

Textbooks and other required material:

Course packet at Cop-Ez.

Recommended material (on reserve in Agriculture and Science and Engineering Libraries):

Mitsch, W. J., and Jorgenson, S. E. 1989. *Ecological Engineering: An Introduction to Ecotechnology*. John Wiley & Sons, Inc., New York.

Kadlec, R. H., and Knight, R. L. 1996. *Treatment Wetlands*. Lewis Pub., Inc., Boca Raton (FL).

Course objective:

To give undergraduate and graduate students an understanding of the processes and attributes on natural systems, including hydrology, biogeochemistry, microbiology, and ecology, and to learn how these components can be utilized to provide societal services. Benefits of ecological engineering technologies will be identified.

Topics:

1. Holistic solutions, energy savings, cost savings.
2. Restoration of ecosystems.
3. Engineered ecosystems.
4. Wetlands.
5. Coastal systems.
6. River systems.
7. Lake systems.
8. Agricultural systems.

An engineering design project:

Students will work in a team to complete an Ecological Engineering research/design project on a topic of their choice (subject to instructor approval). Projects may include designing an Ecological Engineering system for a specific site, or researching a specific application, such as acid mine drainage.

Distribution of Hours

Mathematics:	none
Basic Sciences:	50%
Engineering Topics:	50%
General Education:	none

Grading Plan:

Homework	10%
Project Rept	20%
Midterms (2)	40%
Final Exam	30%

Relationship of Course to Program Objectives and Outcomes

ABET Objectives Addressed:	a, c, d, e, g, h, j, k
Program Objectives Addressed:	1, 2, 4, 5

Faculty Member Preparing Description: Robert M. Sykes April 5, 2006

ENE 619 Environmental Engineering Capstone Design

Catalog Description:

A laboratory demonstration of the treatment processes discussed in 520, and an introduction to pilot-testing procedures for environmental engineering majors.

Credit Hours: U 4

Lecture/Laboratory Schedule: 2 2-hr cl

Prerequisite: 460, 516, 520, 576 and sr standing in environmental eng. Must be taken as close to graduation as possible. Not open to students with credit for CE 519

Textbook and Other Required Material

Textbooks from Prerequisite Courses:

- 516: D. A. Chin (1999), *Water Resources Engineering*, Prentice Hall, Upper Saddle River, NJ.
- 520: R. L. Droste (1997), *Theory and Practice of Water and Wastewater Treatment*, John Wiley & Sons, New York
- 576: C. S. Revelle, E. E. Whitlatch and J. R. Wright (1997), *Civil and Environmental Systems Engineering*, Prentice Hall, Upper Saddle River, NJ

Course Objectives:

To provide student of environmental engineering with a realistic design experience that integrates technical, environmental, economic, societal and ethical considerations and to provide them with additional experience in report preparation and presentation.

Design Project:

Each year the design team(s) will be assigned an environmental engineering problems. The problem will vary from year to year. Each team will organize itself so it includes a project manager who will schedule and chair team meetings and a secretary who will keep records of the meetings and copies of work product. These positions shall be rotated among the team members periodically so that each team member has an opportunity to participate in both of the leadership roles.

The team will meet formally with the instructor (aka, THE CLIENT) at least once per week at a mutually agreeable place and time.

The team will perform at least the following tasks:

1. construct a CPM or GANTT diagram that identifies and schedules the required project activities;
2. identify the relevant OEPA and local regulations;
3. collect enough historical flow data to estimate past and projected loadings and demands;
4. select possible alternative processes and do a preliminary process sizing;
5. select possible alternative site locations and due a preliminary site layout for each process alternative;

6. develop approximate operating and maintenance costs for each alternative;
7. analyze the environmental, social and political impact of the alternatives;
8. choose a final design and site;
9. finish the integrated plant design showing:
 - the arrangement, size and dimensions of each process,
 - the hydraulic piping, pumps and channels that are required to move water through the facility,
 - the hydraulic grade line, process elevations and surface topography along the line of flow,
 - the solids and water balances and flows throughout the plant.

EXPECTATIONS:

General

1. Detailed records will be kept of all work, and a final “bill for engineering services” will be submitted along with the final report:
 - The written records and computer files will be kept in both electronic and hardcopy formats, and the hard copy will be kept in binders.
 - Each team member will keep a detailed (nearest quarter-hour) record of all work activities (including travel) in order to simulate billing. Differentiate between class time, individual work time (by assignment) and team work time (by assignment). You should charge \$35/hr for class time, \$55/hr for team work time and \$65/hr for individual work time.
 - The final bill that is submitted must include both summary costs and a detailed breakout by assignment.
 - Scheduled work will be completed on time.
2. All work will be complete, all assumptions will be documented and all writing will be clear, concise, grammatical and correctly spelled. (You are expected to be able to communicate in an acceptable manner both individually and as a team. Quality and effectiveness of communication is a component of your final grade.)
3. To the extent possible, all work should be printed out as hardcopy in formats suitable for memoranda, reports, drawing, etc.
4. You are expected to function in this class as responsible professionals.
5. The only dumb question is the one you don't ask. At least one of your colleagues is afraid to ask it and will silently thank you for asking.
6. I don't know everything, especially about day-to-day engineering practice, and your colleagues will often be a better source of reliable information.

Team Work

1. By definition, a team shares the work, including the planning and final presentation. It is expected that each team member will be an effective and productive participant. (In this regard, your team mates' opinion of your contribution is a small part of your final grade.)
2. I realize that all of you have substantial constraints on your ability to meet together and work on assignments (either individual or team assignments). You should make use of the scheduled class time as a meeting time and team work time. Other class meetings or meetings with me as either individual or as a team can be scheduled by mutual consent.
3. Difficulties in working together should be worked out as soon as possible. Do not let problems fester. Be honest with each other and respectful. Consider the other commitments that each of you has.

Distribution of Hours:

Mathematics:	none
Basic Sciences:	none
Engineering Topics:	100%

General Education: none

Grading Plan:

Interim Repts	20%
Design Rept	60%
Oral Presentation	10%
Peer Evaluations	10%

Relationship of Course to Program Objectives and Outcomes

ABET Outcomes Addressed:	a, c, e, g, k
Program Objectives Addressed:	1, 2, 4

Faculty member preparing description: Robert Sykes March 2005

ENE 620 Treatment Plant Design Laboratory

Catalog Description:

A laboratory demonstration of the treatment processes discussed in 520, and an introduction to pilot-testing procedures for environmental engineering majors.

Credit Hours:	U 2
Lecture/Laboratory Schedule:	1 cl and 1 3-hr lab
Prerequisite:	CE 610; prereq or concur CE 520

Textbook and Other Required Material

Ronald L. Droste (1997), *Theory and Practice of Water and Wastewater Treatment*.
John Wiley & Sons. (Recommended).

Recommended Standards for Water Works. Health Education Services, 1997. (Required; available at Cop-
ez).

Handouts: <http://www.ceegs.ohio-state.edu/~lweavers/teaching.htm>

Course Objectives:

The objective of this course is to demonstrate the important physical and chemical treatment techniques in a water and wastewater treatment plant learned in CE 520. Pilot plant testing procedures will also be introduced

Topics Covered

1. Analysis of data, functioning as a team
2. Coagulation/Flocculation
3. Sedimentation
4. Adsorption
5. Precipitation/Softening
6. Chemical Stabilization/Finish Adsorption/Softening
7. Disinfection
8. Design of treatment facilities/Design period

Distribution of Hours:

Mathematics:	none
Basic Sciences:	none
Engineering Topics:	100%
General Education:	none

Grading Plan:

Parable preparations	5%
Lab updates	50%
Design Rept	20%
Peer Evaluations	15%
Quiz	10%

Relationship of Course to Program Objectives

ABET Outcomes Addressed:	a, b, c, d, e, g, k
Program Objectives Addressed:	1, 2, 3, 4

Faculty member preparing description: Linda Weavers March 2005

CE/ENE 624: Coastal and Ocean Engineering**Catalog Description:**

Linear and nonlinear waves; water levels; wave forecasting spectra; forces on fixed structures; beach processes; littoral drift and transport; shoreline protection

Required or Elective: Elective

Lecture/Laboratory Schedule: 4 hours lecture

Credit Hours (and quarter(s) offered): 4 (winter)

Prerequisite(s): prereq or coreq: CE406

Textbook(s) and/or Other Required Material:

Coastal Engineering Manual, Electronic Version, US. Army Corps of Engineers, Vicksburg MS., (2004)

Course Objectives (and program outcomes addressed):

1. Students will be skilled in classifying waves into their various linear and nonlinear types as well as making calculations about governing wave parameters such as wavelength, speed, frequency, height, energy and power as a function of depth (a, e, k)
2. Students will be skilled in procedures for estimating bathymetric effects on wave propagation including refraction, diffraction and reflection (a, e, k)
3. Students will be skilled in the methods for making elementary wave forecasts as a function of input measured wind speed direction and fetch (a, e, k)
4. Students will be skilled in spectral and extreme value data analysis methods for analyzing time series of wave and water level data (a, e, k)
5. Students will be skilled in methods for selecting design waves and employing them to calculate forces on slender piles, pipelines and seawalls (a, e, k)
6. Students will be skilled in basic sediment properties including the conditions for initiating motion (a, e, k)
7. Students will be skilled in how beaches respond to various wave conditions and the methods for protecting, restoring, and maintaining beaches (a, e, k).

Topics Covered (and approximate time distribution):

1. Introduction (**0.5 weeks**)
 - definitions - what is coastal engineering;
 - review of basic fluid mechanics, equations of continuity and motion
2. Waves; Deterministic (**3 weeks**)
 - linear wave theory
 - wave group
 - wave energy
 - nonlinear waves
 - refraction, diffraction, contour focusing.
3. Elementary wave forecasting (**1.5 weeks**)

- Sverdrup and Munk; Longuet-Higgins
 - PM method; PN method
 - frequency and period spectra
 - average spectra and design data.
4. Forces on fixed structures (**1.5weeks**)
- hydrostatic forces
 - waves on flat vertical and sloping barriers
 - forces on piles; vibrations
5. Sediment analysis and transport initiation (**0.5 weeks**)
- particle size, composition, and properties
 - settling velocity,
 - critical erosion stress and entrainment
6. Shoreline analysis (**1.5 weeks**)
- beach processes and profiles
 - littoral drift and currents
 - longshore sediment transport
 - shear stress approach; refraction, diffraction revised
7. Methods of shoreline protection (**1.5 weeks**)
- groins
 - headland control
 - inlets
 - walls and revetments
 - beach nourishment
 - dredging.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics: 0.2
 Basic Sciences: 1.2
 Engineering Topics:2.6
 General Education:

Grading Plan:

Homework 10%
 Midterms 50%
 Final Exam 40%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed:1, 2, 4
 Environmental Engineering Program Objectives (1-5) Addressed:1, 2, 4

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a, e, k

Faculty Member Preparing Description: Keith W. Bedford

Date: 5/10/2005

CE/ENE 640 Civil and Environmental Engineering Systems Engineering**Catalog Description:**

Critical path method, linear, integer, and nonlinear programming simulation; mathematical modeling and optimization with design applications in civil and environmental engineering; research paper.

Required or Elective: Elective

Lecture/Laboratory Schedule: 4 cl

Credit Hours (and quarter(s) offered): 4 cr hr; autumn quarter

Prerequisite(s): Prereq: Permission of instructor. Not open to students with credit for 540.

Textbook(s) and/or Other Required Material:

ReVelle, C. S., Whitlatch, E. E., and Wright, J. R. 1997. *Civil and Environmental Systems Engineering*. Prentice-Hall, Upper Saddle River ([NJ]

Course Objectives (and program outcomes addressed):

Introduction to mathematical optimization, cost minimization and conservation of resources in civil and environmental engineering projects. Consideration of design alternatives and decision making.

Topics Covered (and approximate time distribution):

1. Critical Path Method
2. Systems analysis and simple linear programming models
3. Graphical solution procedures and intermediate linear programming
4. Simplex algorithm
5. Integer programming and models
6. Nonlinear programming and models

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	50%
Basic Sciences	
Engineering Topics	50%
General Education	

Grading Plan:

Homework	10%
Midterms (2)	60 %
Final	30%

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a, c, e, k

Relationship of Course to Program Objectives

Civil Engineering Program Objectives (1-5) Addressed: 1, 2,
Environmental Engineering Program Objectives (1-5) Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes, 4/5/06

ENE 711 Bioremediation of Used Water**Catalogue Description:**

Principles and design of biological processes for used water treatment.

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): CE 520 or equiv; not open to students with credit for CE 811.

Textbook(s) and/or Other Required Material

B. E.Rittmann and P. L. McCarty. 2001. Environmental Biotechnology: Principles and Applications. New York: McGraw-Hill.

Course Objectives:

To introduce students of environmental engineering to the principles and design of biological processes for used water treatment, bioremediation and contaminant fate in the environment.

Topics Covered

1. Urban Water Cycle (1 class)
2. Treatment Goals (1 class)
3. Engineering Measures of Organic Matter (1 class)
4. Peaking Factors and Design Loads (1 class)
5. Use of Redox Half-Cells in Microbial Growth Stoichiometry (3 class)
6. Kinetics of Growth and Decay (2 class)
7. Soluble Product Formation (2 class)
8. Activated Sludge Design for Carbon Removal (3 class)
9. Oxygen and Nutrient Requirements (1 class)
10. Aeration schemes (1 class)
11. Nitrification stoichiometry and kinetics (2 class)
12. One sludge vs. two sludge nitrification (3 class)
13. Denitrification stoichiometry and kinetics (1 class)
14. Mulbarger's three sludge process (1 class)
15. Ludzack-Ettinger semi-aerobic process (2 class)
16. Filamentous bulking (1 class)
17. Design of plastic media filters (2 class)
18. Trickling filter aeration (1 class)
19. Trickling filter nitrification (1 class)
20. Anaerobic digestion stoichiometry and kinetics (1 class)
21. Heat and fuel balances (2 class)

Distribution of Hours

Mathematics:	none
Basic Sciences:	30% (microbiology)
Engineering Topics:	70%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed:	a, c, e, k
Program Objectives Addressed:	1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: March 13, 2005

ENE 713 Water Quality and Environmental Measurements**Catalogue Description:**

The application of advanced physical, chemical and computational techniques to environmental engineering problems.

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): 610 or permission of instructor.

Textbook(s) and/or Other Required Material

none.

Course Objectives:

To introduce students of environmental engineering to the principles of environmental sampling and statistics and instrumental chemical analysis

Topics Covered

1. Representative sampling of air, soil and water
2. Sampling equipment
3. Statistical analysis of environmental data
4. Analytical instrumentation

Distribution of Hours

Mathematics:	20%
Basic Sciences:	30% (microbiology)
Engineering Topics:	60%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed:	a, e, k
Program Objectives Addressed:	1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: 4/5/06

CE 714: Hazardous Waste Management**Catalog Description:**

Environmental regulations; site remediation processes; remedial alternatives; implementation; case studies

Required or Elective: Elective

Lecture/Laboratory Schedule: 3 lecture hours

Credit Hours (and quarter(s) offered): 3

Prerequisite(s): CE 520 or permission of instructor

Textbook(s) and/or Other Required Material:

Hazardous Wastes: Sources, Pathways, Receptors, Richard J. Watts, J. Wiley and Sons, 1998. (Required)

Course Objectives (and program outcomes addressed):

1. Students will be able to determine and design appropriate treatment technologies for hazardous site remediation.
2. Students will have an understanding of environmental regulations.
3. Students will be able to calculate the risk at a site based on selected exposure pathways.

Topics Covered (and approximate time distribution):

INTRODUCTION (2 week)

Site assessment/ past practices
 Regulations
 Types of sites and pollutants
 In-situ, ex-situ, vs. off-site remediation

RISK ASSESSMENT (2 weeks)

Toxicity/classes of carcinogens
 Risk assessment

FATE OF CONTAMINANTS (2 weeks)

Properties of contaminants
 Sorption/partitioning
 Volatilization
 Contaminant Transport/Pump and Treat

TREATMENT PROCESSES AND DESIGN (4 weeks)

Physicochemical Processes
 Permeable Walls
 Bioremediation
 Natural attenuation/phytoremediation

Solidification and Stabilization
Incineration

Distribution of Hours Toward Meeting the Professional Component:

Mathematics
Basic Sciences
Engineering Topics: 3
General Education:

Grading Plan:

Homework	15%
Midterms (2)	50%
Presentation	10%
Final Exam	25%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed:
Environmental Engineering Program Objectives (1-5) Addressed: 1, 2, 5

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a,c,e,f,h,j

Faculty Member Preparing Description:Linda Weavers

Date: 5/5/05

ENE 715 Water Resource Systems: Water Quality**Catalogue Description:**

Regional and municipal water supply design and management; water use, law, demand, pricing, supply alternatives, and allocation; and optimal system and component design.

Lecture/Laboratory Schedule: 5 cl

Credit Hours: UG 5

Prerequisite(s): 515 and 540.

Textbook(s) and/or Other Required Material

Milliken, J. G., and Taylor, G. C. 1981. *Metropolitan Water Management*. American Geophysical Union, Washington, D. C.

Course Objectives:

To introduce students of environmental engineering to advanced techniques for the design, analysis and operation of water supply systems.

Topics Covered

1. Overview of water supply management
2. Water law
3. Projecting water use
4. Reservoir safe yield
5. Groundwater safe yield
6. Water conservation
7. Water pricing
8. Reuse/recycle
9. Supply enhancement
10. Macrorouting models
11. Utility financing
12. Cost of water supply systems
13. Optimal component design

Distribution of Hours

Mathematics:	none
Basic Sciences:	none
Engineering Topics:	100%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%

Final Exam 30%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, k
Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: April 5, 2006

ENE 717 Municipal and Industrial Solid Waste Management**Catalogue Description:**

Characterization and sources of solid wastes; solid waste management; collection systems; processing; disposal; and recycle.

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): prereq or concur CE 520

Textbook(s) and/or Other Required Material:

P. A. Vesilind, W. Worrell and D. Reinhart. 2002. *Solid Waste Engineering*. Brooks/Cole, Pacific Grove [CA].

Course Objectives

To introduce environmental engineering majors to the principal means of solid wastes disposal and recycling

Topics Covered

1. Laws and Regulations (2 class)
2. Solid waste sources and quantities (2 class)
3. Composition calculations (2 class)
4. Recycling (7 class)
5. Onsite processing (2 class)
6. Microrouting (4 class)
7. Landfills (9 class)
8. MSW Processing (5 class)
9. Incineration (5 class)
10. Air Pollutant Dispersion (4 class)
11. Composting (3 class)
12. Land disposal (2 class)

Distribution of Hours

Mathematics:	none
Basic Sciences:	10%
Engineering Topics:	80%
General Education:	10%

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, k

Environmental Engineering Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes March 13, 2005

ENE 718 Strategies for Industrial Environmental Management

Catalogue Description:

Industrial environmental management systems, audits, accounting, reports; industrial ecological; design for environment; ISO 9000, 14000, global competition; entrepreneurship, case studies.

Lecture/Laboratory Schedule: 3 cl

Credit Hours: UG 3

Prerequisite(s): prereq or concur: 540.

Textbook(s) and/or Other Required Material

Weaver, G. H. 1996. *Strategic Environmental Management: Using TQEM and ISO 14000 for Competitive Advantage*. Wiley Series in Environmental Management.

Course Objectives:

Students will learn to employ management systems to achieve targeted environmental objectives, cost effective methods to solve problems, methods for lasting chance, how environmental problems affect global competitive abilities of the corporation.

Topics Covered

1. Introduction and historical perspective
2. Total quality management
3. ISO 9000 and 14000
4. Sustainable development and industrial ecology
5. Pollution prevention vs. end-of-pipe technology
6. Environment auditing
7. Environmental performance measurement
8. Environment as a factor in global competition
9. Entrepreneurship

Distribution of Hours

Mathematics:	none
Basic Sciences:	none
Engineering Topics:	100%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, h, j, k
Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: April 5, 2006

ENE 719 Water Quality Modeling

Catalogue Description:

Stream and effluent standards for beneficial uses, and computer modeling of pollutant impacts of rivers.

Lecture/Laboratory Schedule: 3 cl

Credit Hours: UG 3

Prerequisite(s): 520 or equiv with written permission of instructor.

Textbook(s) and/or Other Required Material

S. C. Chapra. 1997. *Surface Water Quality Modeling*. McGraw-Hill, New York.

Course Objectives:

To introduce environmental engineering students to modern, quantitative methods for the analysis of used water impacts on receiving waters.

Topics Covered

1. Beneficial uses and assimilative capacity
2. Waste loads
3. Hydrogeometry
4. Drought flow statistics
5. River transport
6. Streeter-Phelps models
7. Reaeration
8. Sludge Deposits
9. Anoxic reaches
10. Water borne disease models
11. Nitrification
12. Photosynthesis
13. Hazardous material and sediment interactions

Distribution of Hours:

Mathematics:	10%
Basic Sciences:	30% (ecology, epidemiology)
Engineering Topics:	60%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Outcomes Addressed: a, c, e, k
Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: March 13, 2005

CE 720: Environmental Engineering Risk Assessment**Catalog Description:**

Basic methodologies for quantitative risk assessment and applications to a variety of contaminants, pathways, and engineering problem areas.

Required or Elective: Elective

Lecture/Laboratory Schedule: 3 hours lecture

Credit Hours (and quarter offered): 3 (Winter)

Prerequisite(s): CE 540 or permission of instructor

Textbook(s) and/or Other Required Material:

V.T. Covello and M.W. Merkhofer, Risk Assessment Methods, Plenum Press, 1993.

Course Objectives:

Students will study a basic methodology for quantitative risk assessment and its application to a variety of contaminants and pathways. They will become familiar with laws and regulations related to risk assessments and with the increasing use of risk assessment in establishing government and industrial policy and setting priorities. Related topics such as risk management, risk perception, and risk communication will be discussed briefly.

Topics Covered:

Laws, regulations, policies related to risk assessment; overview of the risk assessment process; modeling release assessment; exposure assessment; modeling exposure assessment; methods of assessing health consequences; methods of assessing environmental consequences; risk estimation; risk models; analyzing uncertainty; outputs of risk assessment; evaluation of risk assessment as a tool; acceptability/limitations of risk assessment; EPA Risk Assessment Guidance for Superfund (RAGS); RAGS data collection and evaluation; RAGS exposure assessment and toxicity assessment; radiation risk assessment guidance; risk perception; relative risks of various activities; risk management; risk communication.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics:
Basic Sciences:
Engineering Topics:3
General Education:

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 3, 4, 5

Relationship of Course to Program Outcomes (a-k) Addressed: d, f, g, h, i, j

Faculty Member Preparing Description: Audeen Fentiman, April 30, 2005

CE/ENE 722 River and Open Channel Hydraulics**Catalogue Description:**

Flow classifications, channel properties, energy and momentum principles, critical flow, uniform flow formulas, erodible and nonerodible channel design, and gradually variable flow profile computations

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): 516.

Textbook(s) and/or Other Required Material

V. T. Chow 1959. *Open-Channel Hydraulics*. McGraw-Hill, New York

Course Objectives:

The objectives of this course are to instruct civil and environmental engineering students in the theory and computational techniques for flow analysis and design of natural river channels and constructed open channels.

Topics Covered

1. River geomorphology and open channel cross-sections
2. Flow classification
3. Energy and momentum principles
4. Critical flow and flow gaging
5. Steady, uniform flow
6. Gradually varied flow
7. Rapidly varied flow and spillways
8. Curvilinear and nonprismatic channels
9. Unsteady flow
10. Flood routing

Distribution of Hours

Mathematics:	none
Basic Sciences:	30% (hydrogeology)
Engineering Topics:	70%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, k
Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: April 5, 2006

CE/ENE 723 Environmental Fluid Mechanics**Catalogue Description:**

Water environment momentum, mass, and energy transport; laminar and turbulent mixing; applications to river and lake pollutant dispersal, heated effluent plumes, and eutrophication processes.

Lecture/Laboratory Schedule: 4 cl

Credit Hours: UG 4

Prerequisite(s): 516 and Math 255 or 415, or equiv; not open to students with credit for 614.

Textbook(s) and/or Other Required Material

Kundu. *Fluid Mechanics*. Academic Press, New York.

Course Objectives:

To acquire and understanding of the fundamental principles of fluid mechanics relevant to the natural environment

Topics Covered

1. Conservation laws for mass, momentum and heat: Navier-Stokes
2. Vorticity
3. Dynamic similarity
4. Irrotational flow: velocity potential, settling, flow through porous media
5. Linear wave theory
6. Boundary layer theory
7. Mass transport
8. Turbulence

Distribution of Hours

Mathematics:	none
Basic Sciences:	30%
Engineering Topics:	70%
General Education:	none

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives

ABET Objectives Addressed: a, c, e, k
Program Objectives Addressed: 1, 2

Faculty Member Preparing Description: Robert M. Sykes Date: April 5, 2006

CE/ENE 760 Planning Civil and Environmental Engineering Public Investments**Catalogue Description:**

Water resource planning process, benefit-cost analysis; environmental, economic, and social impacts of civil and environmental engineering projects; project selection; and case studies in water resources, transportation, and energy.

Lecture/Laboratory Schedule: 5 cl

Credit Hours: UG 5

Prerequisite(s): CE 520 or equiv; not open to students with credit for CE 811.

Textbook(s) and/or Other Required Material

none.

Course Objectives:

Students should be able to: (1) discuss the planning process and the role of public participation in the process; (2) determine if an adequate environmental impact assessment/statement has been conducted for a case study project; (3) correctly identify economic benefits and costs for specific types of civil/environmental engineering projects; (4) evaluate the adequacy of agency planning for a case study project; and (5) evaluate the regional economic development effects of a construction project.

Topics Covered

1. Risk and uncertainty
2. Planning area and horizon
3. Opportunity cost, direct and indirect benefits and costs
4. Water Resources Council System of Accounts
5. Planning: goals and objectives, public participation, generation of alternatives
6. National Environmental Policy Act of 1969 and environmental impact assessment methods
7. Benefit-Cost criteria: discount rate, project scale, cost estimation, demand function, willingness to pay, consumer's surplus, alternative cost, net income
8. Applications: irrigation, hydroelectricity, water supply, navigation, transportation, flood control, recreation, commercial fishing, water quality control
9. Regional economic development
10. Social well-being
11. Case studies

Distribution of Hours

Mathematics:	none
Basic Sciences:	30%
Engineering Topics:	70%
General Education:	none

Grading Plan:

Homework	5%
Midterms (2)	40%
Paper	35%
Final Exam	20%

Relationship of Course to Program Objectives

ABET Objectives Addressed:	a, c, e, k
Program Objectives Addressed:	1, 2

Faculty Member Preparing Description: Ear Whitlatch Date: April 5, 2006

ENE/NUE 771: Radioactive Waste Management**Catalog Description:**

This course is a review of the field of radioactive waste management. It defines the various categories of radioactive waste and provides information on sources, volumes, treatment/ storage/disposal methods, applicable regulations, and environmental and economic consideration. Emphasis is placed on the technical problems yet to be solved and current research. The critical topics of waste minimization, decontamination, and decommissioning of nuclear facilities and transportation of radioactive wastes are addressed.

Required of Elective: Elective

Lecture/Laboratory Schedule: 3 hours lecture

Credit Hours (and quarter(s) offered): 3 (Autumn)

Prerequisite(s): NE 505 or NE 606 or permission of instructor

Textbook(s) and/or Other Required Materials:

James Saling and Audeen Fentiman, Radioactive Waste Management, Taylor and Francis, 2002.

Course Objectives:

To provide the student with an understanding of radioactive waste management requirements and practices, to make him/her aware of social, economic, and environmental concerns as well as technical research needs, and to introduce him/her to sources of information not generally consulted by engineering students but important in radioactive waste management.

Topics Covered:

Who needs to know about radioactive waste management; sources of information on radioactive waste; review of some fundamentals of radioactive decay, half-life; background radiation, radiation units, activity; radiation monitoring, protection, and shielding; pathway analysis; nuclear fuel cycle and uses of radioactive materials; categories of radioactive waste; radioactive waste in the news; spent nuclear fuel volumes, storage, treatment options; high level waste sources, volumes, storage, treatment options; low-level waste; transuranic waste; mill tailings; mixed waste; laws and regulations governing radioactive waste; nuclear weapons complex and environmental restoration there; radioactive waste transportation; decontamination and decommissioning; radioactive waste management in other countries.

Distribution of Hours Towards Meeting the Professional Component:

Mathematics:

Basic Sciences:
Engineering Topics: 3
General Education:

Grading Plan:

Homework	10%
Midterms (2)	60%
Final Exam	30%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-6) Addressed: 3, 4, 5

Relationship of Course to Program Outcomes (a)-(k):

Program Objectives Addressed: d, f, g, h, i, j

Faculty Member Preparing Description: Audeen Fentiman

Date: April 30, 2005

CE/ENE 797 Interdepartmental Seminars

Catalog Description: Two or more departments may collaborate in presenting seminars in subjects of mutual interest, topics to be announced.

Required or Elective: Elective

Lecture/Laboratory Schedule: 1 cl hr; repeatable to 5 cr hr

Credit Hours: 1, repeatable to 5 cr hr

Prerequisite(s): Graduate Standing

Textbook(s) and/or Other Required Material: None

Course Objectives:

Students will gain an understanding of current issues in environmental science and engineering

Topics Covered (and approximate time distribution):

Topics vary depending on speakers

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education:	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1
 Environmental Engineering Program Objectives (1-5) Addressed: 1

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: a, c, e, j, k

Faculty Member Preparing Description: Robert M. Sykes **Date:** April 5, 2006

ENE 798: Current Topics in Environmental Science and Engineering

Catalog Description: Seminar course which presents current research findings on environmental quality and pollution control.

Required or Elective: Elective

Lecture/Laboratory Schedule: 1 cl

Credit Hours: 1, repeatable to 3

Prerequisite(s): Graduate Standing

Textbook(s) and/or Other Required Material: None

Course Objectives (and program outcomes addressed):

2. Students will gain an understanding of current issues in environmental science and engineering (j)

Topics Covered (and approximate time distribution):

Topics vary depending on speakers

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Civil Engineering Program Objectives (1-5) Addressed: 1
Environmental Engineering Program Objectives (1-5) Addressed: 1

Relationship of Course to Program Outcomes (j-k):

Program Outcomes Addressed: a, c, e, k

Faculty Member Preparing Description: Harold W. Walker **Date:** April 19, 2005

Appendix E

New Course Requests

and

Course Syllabi

OHIO STATE NEW COURSE REQUEST

Academic Unit Civil & Environmental Engineering & Geodetic Science **150**

Book 3 Listing: Environmental Engineering

Proposed Course No.: (full title of course)

Proposed effective Qtr/Yr: SU ___ AU x WI ___ SP ___ Year: 2008 (see OAA manual for deadlines)

A. Course Offerings Bulletin Information. Follow instructions in the *OAA Procedures Manual*.

Is this a course with decimal subdivisions? If so, use one New Course Request form for the generic information that will apply to all subdivisions. Use separate forms for each new decimal subdivision, including only information that is unique to that subdivision.

18-character Transcript Abbreviation: See attached Level: x U ___ P x G Credit Hours: 1-5

Description (not to exceed 25 words): _____

Quarter offered (check): SU x AU x WI x SP x *Distribution of class time: NA

Prerequisite(s): See attached

Exclusion or limiting clause: NA

Repeatable to a maximum of See attached credit hours.

Cross-listed with: NA

Curricular requirement or limitations (please specify): _____

Special course requirements: NA

Grade Option (please check): Letter: ___ S/U x Progress ___

If this course is Progress graded what course is the last one in the series? _____

Honors statement: Yes ___ No ___

Off-campus: Yes ___ No ___

Other general course information: _____

B. General Information

1. Do you want BRUTUS to enforce the prerequisites? (See OAA Procedures Manual for what BRUTUS can enforce.)

Yes x No ___

2. Curricula in which this course would be required: Environmental Engineering

*If the course offered is less than quarter, term, or semester, also complete the Flexible Scheduled/Off Campus/Workshop Request form.

ENVIRONMENTAL ENGINEERING NEW COURSE REQUEST

Crse Num	Course Name	Prefixes	Description	Prerequisite	Qtrs Offered	Distribution of Contact Time	Level and credit hours	18-char. transcript title
693	Individual Studies	ENE	Individual conferences, assigned readings, and reports on minor investigations.	Permission of instructor. Repeatable to a maximum of 15 cr hrs. Limitations on number of cr hrs applicable toward degrees are governed by departmental rules. This course is graded S/U.	Su, Au, Wi, Sp.		U G 1-5	INDIVIDUAL STUDIES
694	Group Studies in Env Engineering	ENE	The student must register for particular decimals from fields of environmental engineering listed; the topics, cr hrs, and instructors will be announced in quarter previous to the quarter offered	Written permission of instructor. Repeatable to a maximum of 15 cr hrs. Limitations on number of cr hrs applicable toward degrees are governed by departmental rules. This course is graded S/U.	Su, Au, Wi, Sp.		U G 1-5	ENVIRONMENTAL ENG
699	Undergraduate Research in Environmental Engineering	ENE	Opportunity for undergraduate students to conduct research in Environmental Engineering	Repeatable to a maximum of 15 cr hrs. Limitations on number of cr hrs applicable toward degrees are governed by departmental rules. This course is graded S/U.	Su, Au, Wi, Sp.		U G 1-5	UNDERGRADUATE RES
783H	Honors Research	ENE	Supervised research and project work arranged individually for honors students.	Honors standing; permission of instructor. Repeatable to a maximum of 12 cr hrs. Limitations on number of credit hours applicable toward degree are governed by departmental rules. This course is graded S/U.	Su, Au, Wi, Sp	Arr.	U 1-5	HONORS RESEARCH

ENE 693: Individual Studies in Environmental Engineering

Catalog Description: Individual conferences, assigned readings, and reports on minor investigations.

Required or Elective: Elective

Credit Hours: UG 1-5

Prerequisite(s): Permission of instructor. Repeatable to a maximum of 15 cr. hrs. Limitations on number of cr hrs applicable toward degrees are governed by departmental rules. This course is graded S/U.

Textbook(s) and/or Other Required Material: None

Course Objectives: Students will:

1. gain an understanding of current issues in environmental science and engineering ;
2. demonstrate effective communication skills, both oral and written ;
3. demonstrate knowledge of contemporary issues and an understanding of the impact of engineering solutions in a global, economic, environmental, and societal context. Professional and ethical conduct will guide their engineering career.

Topics Covered:

Topics vary according to interests of student and instructor.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 2, 4, 5

Relationship of Course to Program Outcomes (l-k):

Program Outcomes Addressed: b, c, d, f, g, h, j

Faculty Member Preparing Description: Robert M. Sykes **Date:** Jan. 1, 2007

ENE 694: Group Studies in Environmental Engineering

Catalog Description: The student must register for particular decimals from fields in environmental engineering listed; the topics, cr hrs, and instructors will be announced in the quarter previous to the quarter offered.

Required or Elective: Elective

Credit Hours: UG 1-5

Textbook(s) and/or Other Required Material: None

Course Objectives: Students will:

1. gain an understanding of current issues in environmental science and engineering ;
2. demonstrate effective communication skills, both oral and written ;
3. demonstrate knowledge of contemporary issues and an understanding of the impact of engineering solutions in a global, economic, environmental, and societal context. Professional and ethical conduct will guide their engineering career.

Topics Covered:

Topics vary according to interests of student and instructor.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 2, 4, 5

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: b, c, d, f, g, h, j

Faculty Member Preparing Description: Robert M. Sykes **Date:** Jan. 1, 2007

ENE 699: Undergraduate Research in Environmental Engineering

Catalog Description: Supervised research and project work arranged individually for undergraduate students..

Required or Elective: Elective

Textbook(s) and/or Other Required Material: None

Course Objectives: Students will:

1. gain an understanding of current issues in environmental science and engineering ;
2. demonstrate effective communication skills, both oral and written ;
3. demonstrate knowledge of contemporary issues and an understanding of the impact of engineering solutions in a global, economic, environmental, and societal context. Professional and ethical conduct will guide their engineering career.

Topics Covered:

Topics vary according to interests of student and instructor.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 2, 4, 5

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: b, c, d, f, g, h, j

Faculty Member Preparing Description: Robert M. Sykes **Date:** Jan. 1, 2007

ENE 783H: Honors Research in Environmental Engineering

Catalog Description: Supervised research and project work arranged individually for honors students..

Required or Elective: Elective

Textbook(s) and/or Other Required Material: None

Course Objectives: Students will:

1. gain an understanding of current issues in environmental science and engineering ;
2. demonstrate effective communication skills, both oral and written ;
3. demonstrate knowledge of contemporary issues and an understanding of the impact of engineering solutions in a global, economic, environmental, and societal context. Professional and ethical conduct will guide their engineering career.

Topics Covered:

Topics vary according to interests of student and instructor.

Distribution of Hours Toward Meeting the Professional Component:

Mathematics	none
Basic Sciences	50%
Engineering Topics	40%
General Education	10%

Grading Plan (S/U):

Participation	20%
Papers	80%

Relationship of Course to Program Objectives:

Environmental Engineering Program Objectives (1-5) Addressed: 2, 4, 5

Relationship of Course to Program Outcomes (a-k):

Program Outcomes Addressed: b, c, d, f, g, h, j

Faculty Member Preparing Description: Robert M. Sykes **Date:** Jan. 1, 2007