

Proposal for Graduate Certificate Program in Environmental Engineering

1. Name of the proposed graduate certificate

Graduate Certificate in Environmental Engineering

2. Name of the departments and/or programs involved

The Department of Civil, Construction and Environmental Engineering will take the lead, but courses in other departments will be allowed for credit.

3. Need for the graduate certificate

There are a number of engineers, mainly civil engineers, who have a desire to further their education in environmental engineering to add more specialization to their general undergraduate studies. The Graduate Certificate represents an opportunity to acquire the essential specialization in environmental engineering in a short program and on a part-time basis. The Certificate program is designed to meet the education needs of both traditional and non-traditional students in allowing completion of four specialized courses and a seminar. While some of these engineers could complete master's degrees in this area at either Iowa State University or at the University of Iowa, there are only a limited number of engineers willing or able to afford to complete two years of full-time study to obtain this qualification.

At least 23 other universities offer graduate certificates in engineering. Amongst these are the Universities of Minnesota, Michigan, Wisconsin - Madison, Tennessee - Knoxville, Southern California, Louisville and Central Florida, also Stanford, Rutgers, Portland State, Tufts, Washington - St. Louis, Villanova, Texas A & M and Johns Hopkins Universities, Worcester Poly and New Jersey Institute of Technology.

4. Objectives of the graduate certificate

The ultimate goal of the certificate program is to reinforce, broaden, and integrate environmental education into the curriculum and make ISU responsive to educational demands of a growing and advancing field in supply of essential services, environmental protection, and better management of wastes and recovery of byproducts. To reach this goal, the main objectives of the certificate program are outlined below.

a) Promote interdisciplinary collaboration for graduate curriculum development

As an inherently multi-disciplinary curriculum, the certificate program will allow study in various departments and colleges.

b) Strengthen communication across the curriculum

The certificate program will strengthen communication across the curriculum among faculty and students from different disciplines. It will allow traditional and non-traditional students from various disciplines to come together for shared learning experiences. It will also reinforce faculty communication across the curriculum as faculty from different disciplines will be teaching some of the optional courses.

c) Strengthen academic programs for nontraditional students

Because environmental engineering is a growing and rapidly advancing field, courses in the certificate will be valuable to practicing professionals who will need this education to keep pace and acquire new skills. The certificate program will thereby help strengthen academic programs for non-traditional students. The technology-based and application-oriented nature of environmental engineering studies will prepare students for the challenges posed by the growing industrial base of Iowa, help to ensure sustainable agricultural practices and help ensure the provision of quality municipal services. Additional students will also help the program to grow.

d) Promote the use of student outcomes assessment to enhance student learning

Environmental engineering education, because it is application-oriented, emphasizes learning by doing. Environmental engineering will be taught through individual exercises and group projects based on real world problems. A set of competency standards will be developed as the basis for student outcomes assessment. The students themselves, their peers, and the instructors will evaluate the success of student projects as well as the capability and skill levels of the students. The approach of competency-based student outcomes assessment will enhance student learning.

e) Encourage articulation into master's programs

Credit for courses completed for the certificate will be allowed for credit in the master's degree in environmental engineering. The extent of this will have to be determined by requirements set for the master's degree program.

5. General description of the graduate certificate program

a) Student learning outcomes

The curriculum for the certificate program has been developed to help students accomplish the following:

- understand the principles (theory) of environmental chemistry and biotechnology and methodologies of environmental engineering with emphasis on applications,
- apply conceptual and technical knowledge to real-world problem solving by selecting courses related to each student's area of interest,
- understand the appropriate role of the professional and the ethical standards in environmental engineering practice,
- be exposed to recent research in environmental engineering through seminars and making a contribution with an own seminar.

b) Curriculum description

There are two core courses and a seminar course from the Department of Civil, Construction and Environmental Engineering and two courses may be selected from a number of courses offered by different departments at ISU.

It will be expected that the additional courses will cover some form of environmental engineering application, subject to approval by the Director of Graduate Certificate Studies, appointed by the environmental engineering faculty.

The required courses* are:

- CE 520 Environmental Engineering Chemistry
- CE 521 Environmental Biotechnology
- CE 591 Environmental Engineering Seminar **

Suggested courses:

Any two courses related to environmental engineering may be chosen from those available from the Departments of Civil, Construction and Environmental Engineering, Agriculture and Biosystems Engineering and Chemical Engineering. A suggested list of suitable courses follows below.

- CE522 Water Pollution Control Processes
- CE523 Physical-Chemical Treatment Technology
- CE524 Air Pollution
- CE525 Industrial Water Management and Resource Recovery
- CE527 Solid Waste Management
- CE529 Hazardous Waste Management
- CE569 Environmental Geotechnology
- CE570 Applied Hydraulic Design
- CE571 Surface Water Hydrology
- CE572 Analysis and Modeling Aquatic Environments
- CE573 Groundwater Hydrology
- CE574 Environmental Impact Assessment
- CE590 Independent Study
- AE520 Agricultural Water Quality Engineering
- AE522 Drainage and Irrigation Engineering
- AE523 Erosion and Sedimentation Transport
- AE573 Manure Treatment and Bioconversion
- ChE562 Bioseparations
- BRT 501 Fundamentals of Biorenewable Resources

Other graduate level courses offered within the Biorenewables Program.

Relevant graduate level courses offered in related disciplines.

* Environmental Engineering faculty as represented by the Director of Graduate Certificate Studies may require completion of one or more undergraduate courses if the candidate's background is deficient in environmental engineering. Approval may also be given to substitute other courses if equivalent courses have already been completed.

* * Students are required to present one seminar on a suitable topic in CE591 before graduation. Attendance of the seminar course CE591 is strongly encouraged.

6. Graduate certificate requirements

A minimum of 12 approved graduate credits is required to receive the certificate. In addition, students must maintain a grade average of B or higher in these courses. A seminar presentation on an acceptable topic is required in an R credit seminar attendance course.

a) Prerequisites for prospective students and any special admission standards for candidates

To be admitted into the certificate program, prospective students should meet one of the following admission standards:

- a bachelor degree or higher in an engineering discipline, or
- qualified ISU undergraduate students.

In all cases, students would need to be in the top half of their peer group for full admission, typically with a grade point average of 3.0 or more.

Students may transfer up to 6 credits from other institutions, subject to approval by the Director of Graduate Certificate Studies in the Department of Civil, Construction and Environmental Engineering.

Undergraduates can take up to 9 credits of graduate courses (beyond the requirements of their undergraduate degree), with the approval of the Department of Civil, Construction and Environmental Engineering, and apply them to the certificate. After completing their under-graduate degree, they would enroll as a graduate student and finish the remaining certificate requirements.

b) Courses and seminar

To meet all requirements, students should complete the following coursework:

- 6 core credits from the CCE courses as listed above,
- 6 credits from the pool of courses listed above or as approved by CCE faculty,
- attend CE591 Seminar and present a seminar

7. General description of the resources currently available and future resource needs

a) Faculty members

T. Al Austin, Professor of Environmental Engineering, Water Resources and Hydrology
Tim G Ellis, Associate Professor of Environmental Engineering, Wastewater Treatment
Ruanchan Gu, Associate Professor of Environmental Engineering, Hydrology and Hydraulics
Say-Kee Ong, Associate Professor of Environmental Engineering, Waste Management

Shih-Wu Sung, Assistant Professor of Environmental Engineering, Wastewater Treatment
J(Hans) van Leeuwen, Professor of Environmental Engineering, Industrial Wastewater and
Physical-Chemical Processing, Drinking Water Treatment, Resource Recovery

Adjunct Faculty

Maohong Fan, Resource Recovery and Air Pollution Control

Stephen Jones, P.E., Extension Civil Engineer; Drinking Water Treatment, Water and
Wastewater Treatment; Engagement with Practicing Civil Engineers and Industry in Iowa

b) Effects of any new courses on the work load of the present faculty

The effects of any new courses on the work load of the present faculty will be minimal as these are existing courses. Individual faculty will be assigned to act as advisors or major professors, but no Program of Study Committees are foreseen.

c) Other resources including graduate assistants, laboratories and other facilities, supplies, etc.

Two graduate teaching assistants are normally available to help with certain tasks. The department also employs three graduate chemists with extensive experience in environmental analyses and to help with laboratory practical teaching. The new Anderlik Environmental Engineering Laboratory has sufficient equipment for teaching these courses. Residual funds in the generous donation by the Anderliks and others will be used to equip the laboratory further to become one of the premier teaching laboratories in environmental engineering in North America.

8. Relationship of the proposed graduate certificate to the strategic plans of the department, college and the university

The Certificate program will help promote several core goals of the university, the College of Engineering and the Department of Civil & Construction Engineering in their strategic plans.

a) Meeting university goals

The Iowa State University Strategic Plan for 2000-2005 is structured around goals that lie in the intersecting arenas of learning, scholarship and engagement. The proposed certificate program will support goals in each of these arenas and intersections. In the arena of learning it will promote widespread use of information technology and its integration into the curricula, and it will help students develop critical thinking and information management skills that will make them more competitive in career placement. In the arena of scholarship it will help students develop skills to support faculty in meeting the goals of using information science and technology innovation in various dimensions of scholarship. In the arena of engagement it will, by supporting outreach activities and serving nontraditional students, address the needs of Iowa communities, be responsive to the needs of contemporary society, expand outreach, expand the range of programs available to the needs of a growing workforce, and promote the widespread use of information technology in outreach programs. At the

intersection of these three arenas, it will promote “integration and effective use of information technology and computation services”, and “encourage and support interdisciplinary collaboration”. In short, it will rise to meet the obligations of a top land-grant university.

b) Meeting college goals

The College of Engineering also embraces the goals of fostering teaching, scholarship and outreach on an interdisciplinary basis. The certificate program will support interdisciplinary efforts for studying and understanding the physical environment. The proposed certificate will also meet the college goals of providing a forum for direct interaction among students, faculty and pre-professionals involved in protecting the environment. As a certificate available to students from different disciplines, the certificate program will support the college goal of providing opportunities for all students in the university to undertake studies in environmental engineering.

c) Meeting departmental goals

In addition to meeting departmental goals that are consonant with university and college goals—those related to interdisciplinary collaboration, nontraditional students, and outreach and scholarship—the certificate program will also meet more specific department goals. To this end, it will support the goal of integrating instructional, research and outreach efforts. Because environmental engineering entails analysis and solution of real-world problems, the certificate will promote the departmental goal of focusing its scholarship “on the real-world, problem-solving needs of the built environment.” Moreover, it will also support the departmental goal of supporting the local community in sophisticated and meaningful ways.

9. Plan for periodic review of the certificate program

Currently, the Department of Civil, Construction and Environmental Engineering aims at improving the master’s program in environmental engineering to meet the requirements for graduates to prequalify for professional registration as environmental engineers by the Accreditation Board of Engineering and Technology. Changes in this curriculum may precipitate the need to review the content and philosophy of the certificate program.

A need to involve other departments more directly may result in a slightly different program or in more graduate certificates. The needs of non-engineers may also have to be addressed in a certificate covering mainly the same concepts, but avoid use of calling it an “engineering” qualification – maybe in “environmental technology”.

All programs within the Department of Civil, Construction and Environmental Engineering are controlled by the departmental curriculum committee, on which representatives of all programs serve. This committee is also subject to review by the department’s advisory committee, on which professionals from a number of employers serve. The advisory committee and other professionals within the industry will be asked for advice with respect to scope and content of the certificate program.