The Johns Hopkins University

Department of Geography and Environmental Engineering

Undergraduate Programs

(updated 8/29/13)

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INTRODUCTION

The field of Environmental Engineering is dedicated to the study and amelioration of environmental problems. Such problems are complex and multifaceted, and successful solutions must operate within the constraints imposed by societal concerns. As a result, the discipline of Environmental Engineering is a highly interdisciplinary endeavor.

The B.S. in Environmental Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Program Objectives

The Program in Environment Engineering educates students to think critically, communicate clearly, and collaborate effectively as they apply the fundamental scientific principles of engineering to environmental problems. We emphasize the importance of intellectual growth, professional ethics, and service to society. Our graduates are prepared to be successful

(1) engineering professionals in private and governmental organizations, and
(2) students in the best graduate programs.

Our program was implemented for the first time during the 2002-2003 academic year and is intended to provide a strong foundation in the physical, chemical and biological sciences, as well as in mathematics, engineering science and engineering design. It is broad and flexible enough to accommodate students with a variety of interests in Environmental Engineering. This training should provide an ideal preparation for future employment in business or industry or for subsequent training at the graduate level, either in Environmental Engineering or in a field such as environmental law, public health, or medicine.

Academic Programs

The Department of Geography and Environmental Engineering offers the following programs for undergraduates at Johns Hopkins:

- The Bachelor of Science in Environmental Engineering program is designed to provide students with a broadly based yet rigorous education in the fundamental subjects central to the field, in a milieu that fosters development of a spirit of intellectual inquiry and the problem-solving skills required to address the open-ended issues characteristic of the real world.
- The Minor in Environmental Engineering is designed to allow engineering students to pursue an interest in this field and to incorporate aspects of environmental engineering into careers in other engineering disciplines.
- The Minor in Environmental Science is designed to encourage and facilitate studies in environmental science by students completing degrees in other science and engineering disciplines.
- The Minor in Engineering for Sustainable Development is designed to expose students to some of the key issues related to development, methods of information-gathering in diverse and difficult settings, and working effectively with non-engineers on complex problems.

Advising

The Department's coordinator for undergraduate advising is:

Professor Ben Hobbs
208 Ames Hall
3400 N. Charles Street
Baltimore, MD 21218
(410) 516-4681, bhobbs@jhu.edu

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The Department's Program Director for the Minor in Engineering for Sustainable Development is:

Professor Erica Schoenberger
Dept of Geography and Environmental Engineering
501 Ames Hall
410-516-6158, ericas@jhu.edu

All undergraduate students majoring in Environmental Engineering must follow a program approved by a faculty member in the Department who is appointed as the student's advisor. It is the responsibility of the student to initiate and attend regular meetings with the advisor.
Each student must meet with his/her advisor at least twice a semester to:

- plan or make changes to his/her course schedule,
- discuss requirements for the major, and
- discuss any problems that relate to academics or academic performance.

For example, a meeting with the advisor approximately four weeks after classes begin provides a useful time to inform the advisor of potential difficulties or problems in individual courses. The second meeting with the advisor would typically occur towards the end of the semester during advising week.

IMPORTANT NOTE: All Environmental Engineering Majors must fill out and obtain their advisor's signature on a checkout sheet at the beginning of each semester. Submit signed check out sheets to DoGEE in person (Ames Hall 313) or via email (dogee@jhu.edu) prior to registering each semester. **A blank copy of this mandatory checkout sheet can be found at the end of this Advising Manual.**

Note **that undergraduate advising week is the week BEFORE undergraduate registration week.** Please schedule an appointment with your advisor, since he or she will likely have a particularly busy schedule during this time. For more information on how to register, important announcements, and deadlines please visit http://www.jhu.edu/registr/notices_undergrad.html

Responsible Conduct of Research Course

http://eng.jhu.edu/wse/page/conduct-of-research-training

Any undergraduate student (from any school) cannot begin receiving payment from the Whiting School of Engineering to conduct research until he/she has completed the online training course in Responsible Conduct of Research (AS.360.624). Students must present a certificate of course completion (which can be printed or saved electronically) to the department/center administrator for verification. [EXCEPTION: Undergraduate students on NIH training grants* must complete the in-person training course (AS.360.625, not the online course) at the first available opportunity and may be placed on payroll before the course is completed. This course is offered during the summer, fall, intersession, and spring sessions. (A course description can be found

in ISIS.) During the appropriate online registration periods, students can register for the in-person course via ISIS. Outside of the online registration periods, students must visit the Office of the Registrar to enroll.] NOTE: Undergraduate students who must complete Responsible Conduct of Research training will not receive a diploma until course completion is verified. Please contact your Sr. Academic Program Coordinator if you have questions about this course.

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GENERAL REGULATIONS FOR THE ENVIRONMENTAL ENGINEERING MAJOR

All undergraduate students majoring in Environmental Engineering must follow a program approved by a faculty member in the Department who is appointed as the student's advisor.

Course and Grade Regulations

The Department of Geography and Environmental Engineering requires that all courses taken after the first semester of the freshman year and counted toward the 125 credits required for Environmental Engineering be taken for a letter grade (that is, they may not be taken with the Satisfactory/Unsatisfactory option). The University regulations can be found in the JHU catalog. Whereas the University allows one S/U course each semester *outside the student's major*, the Department does not allow any S/U courses (except those in the first semester of the Freshman year) to count toward the requirements for graduation.

Further, the Department of Geography and Environmental Engineering requires that grades of C- or better be obtained in all required Engineering, Mathematics and Science courses (i.e., grades of D or D+ will not be accepted). This also applies to required electives in those three areas. No more than ten D credits may be counted toward graduation requirements.

According to University regulations, no more than 12 credits completed prior to matriculation or in summer sessions at other accredited colleges or universities may be accepted. Transfer students are not subject to this restriction. They must obtain credit for courses they wish to transfer during their first year at Hopkins. University regulations also require a minimum of two years residence for a Hopkins degree.

Advanced Placement

Johns Hopkins University grants credit for many Advanced Placement (AP) examinations. If you took AP exams, please have your scores sent to Johns Hopkins University as soon as possible. AP scores will be entered on your academic record upon receipt. The Whiting School's Office of Academic Affairs decides what AP credits can be counted toward an engineering degree. Please visit the link below if you have questions about your AP credits:

http://engineering.jhu.edu/academic-advising/

CHEMISTRY: A score of four or five on the AP Chemistry exam exempts a student from taking the Intro Chemistry I and II sequence (030.101, 030.102). In that case, Chemistry Lab is waived.

PHYSICS: A score of four or five on Physics C (parts one and two) exempts a student from the Physics I and II sequence (171.101, 171.102), **but the corresponding Physics Labs (173.111, 173.112) are required.** No AP credit is awarded for Physics B. For additional information about AP credits, please consult your Engineering 101 Program Planning Guide provided by the Whiting School of Engineering.

BIOLOGY: AP Biology credits may only count towards satisfying an introductory required biology class (100 level). Please note that AP Biology credits may not satisfy the Ecology course requirement.

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ENVIRONMENTAL ENGINEERING MAJOR CURRICULUM

Our Mission

The mission of the environmental engineering undergraduate program is to provide students a broadly based yet rigorous education in the fundamental subjects central to the field, in a milieu that fosters a spirit of intellectual inquiry and the development of problem-solving skills required to address the open-ended issues characteristic of environmental engineering problems. The fundamental subjects include the physical, chemical, biological, and social sciences; mathematics; engineering science; the principles of environmental engineering; and the art and science of engineering design. This training is meant to prepare students for future employment as professional engineers, and for subsequent training at the graduate level, either in Environmental Engineering, other engineering and scientific fields, or professions such as business, law, public health, and medicine.

Educational Objectives

The Program in Environment Engineering educates students to think critically, communicate clearly, and collaborate effectively as they apply the fundamental scientific principles of engineering to environmental problems. We emphasize the importance of intellectual growth, professional ethics, and service to society. Our graduates are prepared to be successful

(1) engineering professionals in private and governmental organizations, and
(2) students in the best graduate programs.

Student Outcomes

The undergraduate environmental engineering program is designed to produce environmental engineering graduates who:

- Understand the principles upon which engineering practice is based, including mathematics and scientific computation; engineering science; and relevant principles of the physical, chemical, biological, and social sciences;
- Have knowledge and skills to design, conduct, and evaluate experiments;
- Understand the need for multidisciplinary approaches to engineering solutions to environmental problems, and the cross-media (air, water, soil) nature of environmental problems, and have a practical understanding of the social nature of environmental problems and their potential engineering solutions;
- Demonstrate critical thinking skills and an ability for independent study needed to engage in life-long learning;
- Possess knowledge and skills to identify, formulate, and implement solutions to engineering problems using modern engineering tools and synthesizing different fields of knowledge;
- Can communicate effectively both orally and in writing, and collaborate in multidisciplinary teams;
- Are broadly educated to understand contemporary issues and the policy context in which environmental engineering is practiced in modern society;
- Have access to specialized training through coursework and research; and

- Understand professional ethics and the value of service through participation in technical activities and in professional organizations.

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Environmental Engineering Curriculum

With the assistance of a faculty advisor, each student will plan a curriculum suited to his or her ultimate career goals. The program also encourages individual study and research. The program of study we have designed satisfies the Accreditation Board for Engineering and Technology (ABET) criteria, and we are an ABET approved program. Advanced training through participation in a senior design project involves synthesizing information from more than one field to solve real-world problems.

Focus Areas within the Environmental Engineering Major

Students must select among four different focus areas:

- Environmental Management and Economics
- Environmental Engineering Science
- Environmental Transport
- Environmental Health Engineering

The Environmental Engineering curriculum is structured as follows, and involves a total of 125 credits:

Mathematics (M) with a focus on applications (19 credits)

Required Courses:

110.108 Calculus I (Physical Sciences and Engineering)
110.109 Calculus II (Physical Sciences and Engineering)
110.202 Calculus III (Physical Sciences and Engineering) or 110.211 Honors Multivariable Calculus and Linear Algebra
550.291 Linear Algebra and Differential Equations or 110.302 Differential Equations with Applications
An advanced course (300 level or higher) in probability and statistics (The Department of Applied Mathematics and Statistics offers a number of suitable courses)

Basic Science (BS) (24-25 credits)

Required Courses:

171.101 General Physics for Physical Science Majors I
171.102 General Physics for Physical Science Majors II
173.111 General Physics Laboratory I
173.112 General Physics Laboratory II
One year of introductory chemistry (e.g., 030.101 Introductory Chemistry I and 030.102 Introductory Chemistry II)
030.105 Introductory Chemistry Laboratory I
030.106 Introductory Chemistry Laboratory II
570.205 Ecology
An additional course in the biological sciences, such as 020.151 General Biology I, or 570.328 Geography and Ecology of Plants.

Note: Premedical students could substitute 020.305 Biochemistry, 020.315 Biochemistry Laboratory, 020.306 Cell Biology, and 020.316 Cell Biology Laboratory, for Ecology or General Biology. Premedical students

should also take additional chemistry courses as electives, such as 030.205 Introductory Organic Chemistry I, 030.206 Introductory Organic Chemistry II, and 030.225 Organic Chemistry Laboratory.

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Humanities and Social Sciences (HS) (18 credits)

A minimum of six courses totaling 18 credits in Humanities or Social Sciences (catalog code H or S). The six courses must include 1) one course that specifically develops writing skills (e.g., a how to write class), 2) 570.334 Engineering Microeconomics, and 3) four additional H&S courses with at least two at the 300 level or higher. 570.404 and/or 570.406 can be taken as part of these requirements. Please note that the writing course will fulfill one of the two writing intensive courses required by the university (W courses). Note also that most medical schools require a year of English literature and/or composition.

Required course:

570.334 Engineering Microeconomics

Elective examples from DoGEE:

570.406 Environmental History
570.427 Natural Resources, Society, and Environment

Writing course examples:

220.146 (H, W) Introduction to Science Writing
220.202 (H,W) Introduction to Nonfiction
060.113 or 060.114 Expository Writing (either one; both cannot be counted for H/S credit)
220.105 or 220.106 Introduction to Fiction and Poetry I

General Engineering (GE) (16 credits)

Required courses:

570.108 Introduction to Environmental Engineering
An introductory course in computing (570.210, Introduction to Computation and Mathematical Modeling or an equivalent course)
A course in thermodynamics (e.g., 540.203 Engineering Thermodynamics, 510.312 Physical Chemistry of Materials I: Thermodynamics, or 530.231 Mechanical Engineering Thermodynamics)
A course in Statics (either 560.201 Statics and Mechanics of Materials or 530.201 Statics and Mechanics of Materials)
570.351 Introduction to Fluid Mechanics

Design Experience and Engineering Laboratory (D) (9 credits)

Required courses:

570.305 Environmental Engineering Systems Design
570.419, 570.421 Environmental Engineering Design I, II

The Design and Synthesis sequence is a five-credit project course (2 credits fall semester, 3 credits spring semester) and involves a comprehensive study of the engineering design process from problem definition to final design. The course involves team projects that include written and oral presentations. Students will form small teams that will work with local companies or government agencies in executing the project. Prerequisite: senior standing in Environmental Engineering.

Environmental Engineering Requirements (EER) (27 credits)

Required courses (15 credits):

570.239 Current and Emerging Environmental Issues
570.301 Environmental Engineering I: Fundamentals
570.302 Environmental Engineering II: Water and Wastewater Treatment
570.304 Environmental Engineering and Science Laboratory
570.353 Hydrology

Environmental Engineering Electives (EEE) (12 credits):

Students take at least two courses from one of the following focus areas, and at least one course from two of the other focus areas. Courses to be selected in consultation with advisor. **Any changes in courses must be accompanied by a Waiver/Substitution Form.**

Environmental Management and Economics (Note: 600 level courses require permission of instructor)
570.418/618 Multiobjective Programming and Planning
570.496 Optimization Models in Environmental Systems
570.497 Risk & Decision Analysis
570.490 Solid Waste Engineering and Management
570.491 Hazardous Waste Engineering and Management

Environmental Engineering Science
570.411 Engineering Microbiology
570.442 Environmental Organic Chemistry
570.443 Aquatic Chemistry
570.460 Environmental Colloidal Phenomena

Environmental Transport
530.328 Fluid Mechanics II
570.423 Principles of Geomorphology
570.432 Sediment Transport and River Mechanics
570.657 Air Pollution

Environmental Health Engineering
182.625 Principles of Occupational and Environmental Hygiene*
182.638 Environmental and Health Concerns in Water Use and Reuse*
280.350 Fundamentals of Epidemiology
221.624 Urban Health in Developing Countries*
180.600 Water and Sanitation in Tropical Environments*

* These courses are offered on the Bloomberg School of Public Health campus.

Technical Electives (TE) (minimum of 12 credits) (selected in consultation with an advisor)

At least three (E), (Q) or (N) courses at or above the 300 level subject to approval by the department and totaling at least twelve credits. (For ABET requirements at least one from: Solid Waste; Hazardous Waste; Air Pollution; Environmental Health Engineering, if not satisfied as part of the Environmental Engineering electives.) Up to six credits of independent study or research may be applied toward engineering requirements

(e.g., 570.501/502 Undergraduate Research, 570.505 Undergraduate Independent Study, or 570.499 Senior Thesis). Note earlier comments for premed majors.

It is strongly recommended that students take additional advanced classes in computing and numerical methods. Environmental Engineering Science students are strongly encouraged to take at least one course in organic chemistry (e.g., 030.205 Introductory Organic Chemistry I). The organic chemistry course will meet the Technical Elective requirement.

Guidance for Technical Electives for Environmental Engineering Major

1. Technical electives (TEs) are intended to provide students with courses with technical content and extend mastery in appropriate subject matter.
2. TEs require use of fundamental science or mathematics, have appropriate prerequisites (e.g., university-level calculus, physics, chemistry, or other N or Q courses) and generally at a 300 level or higher.
3. TEs must have the appropriate level of rigor which is defined as encompassing both of the following requirements: (a) 5-10 homework assignments; and (b) a culminating project (final project, group project, paper) or final examination. Lecture-only classes (no homework or exams) will not qualify as a TE for the EE major.
4. TEs require accumulation and depth of analytical skill or knowledge. In general, this precludes survey courses or courses that have no technical prerequisites that are taught by multiple professors or a series of guest lecturers, or cover a broad spectrum of a topic instead of building mastery in one area.

Exceptions are possible only with the approval of either the Departmental Chair or Director of Undergraduate Studies.

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Sample Environmental Engineering Program

This program satisfies the Environmental Engineering BS with a concentration area in environmental engineering science. This program is based on the assumption that students have not previously completed A.P. courses in Calculus, Physics, Chemistry, etc.

First year----------

Semester 1

110.108 Calculus I (Physical Sciences and Engineering)	4 (M)
030.101 Introductory Chemistry I	3 (BS)
030.105 Introductory Chemistry Laboratory I	1 (BS)
570.108 Introduction to Environmental Engineering	3 (GE)
H/S Elective 1	3 (HS)
Total	14

Semester 2

110.109 Calculus II (Physical Sciences and Engineering)	4 (M)
030.102 Introductory Chemistry II	3 (BS)
030.106 Introductory Chemistry Laboratory II	1 (BS)
171.101 General Physics for Physical Sciences Majors I	4 (BS)
173.111 General Physics Laboratory I	1 (BS)
570.210 Intro. to Computation and Math. Modeling	3 (GE)
Total	16 (Annual 30)

Second year

Semester 1

550.291 Linear Algebra and Differential Equations	4 (M)
171.103 General Physics for Physical Science Majors II	4 (BS)
173.112 General Physics Laboratory II	1 (BS)
560.201 Statics and Mechanics of Materials	4 (GE)
570.205 Ecology	3 (BS)
Total	16

Semester 2

110.202 Calculus III (Calculus of Several Variables)	4 (M)
510.312 Physical Chemistry of Materials I: Thermodynamics	3 (GE)
570.239 Current and Emerging Environmental Issues	3 (EER)
H/S Elective 2	3 (HS)
H/S Elective 3	3 (HS)
Total	16 (Annual 32)

Sample Environmental Engineering Program Cont.

Third year

Semester 1

570.301 Environmental Engineering I: Fundamentals	3 (EER)
570.305 Environmental Engineering Systems Design	4 (D)
570.334 Engineering Microeconomics	3 (HS Elective 4)
570.351 Introduction to Fluid Mechanics	3 (GE)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Total	16

Semester 2

Probability/Statistics course	3 (M)
020.151 General Biology	3 (BS)
570.302 Environmental Engineering II	3 (EER)
570.304 Environmental Engineering and Science Lab.	3 (EER)
H/S Elective 5	3 (HS)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Total	18 (Annual 34)

Fourth year

Semester 1

570.353 Hydrology	3 (EER)
570.419 Environmental Engineering Design I	2 (D)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Total	14

Semester 2

570.421 Environmental Engineering Design II	3 (D)
H/S Elective 6	3 (HS)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Environmental Engineering or Technical Elective	3 (EEE or TE)
Total	15 (Annual 29)

Math (M) = 19 credits; Humanities and Social Sciences (HS) = 18 credits; Basic Science (BS) = 24 credits; General Engineering (GE) = 16 credits; Environmental Engineering Requirement (EER) = 15 credits; Environmental Engineering Electives (EEE) = 12 credits; Technical Electives (TE) = 12 credits; Design (D) = 9 credits; **Total Credits = 125**

HUMANITIES AND SOCIAL SCIENCE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING MAJORS

The Whiting School of Engineering requires a minimum of six courses (each of at least three credits) in Humanities or Social Sciences (catalog code H or S).

Students taking elements of a foreign language are granted an H area designator for both semesters only if the second semester course is successfully completed (see the Johns Hopkins Catalog, page 43). For example, a student successfully completing 090.101 and 090.102 *Elementary German* would get 8 H credits. (Note that while four H credits are given for 090.102 alone, no H credits are given for 090.101 alone).

Writing Requirement

Whiting School graduates must take two courses (6 credits) that carry the writing intensive (W) designation. You must work with your advisor to find writing courses that guarantee the desirable level of intensity in writing instruction. One of the W courses must specifically develop writing skills. Example courses that do satisfy this requirement include:

220.146 (H, W) Introduction to Science Writing
220.202 (H, W) Introduction to Nonfiction
060.113 or 060.114 Expository Writing (either one; both cannot be counted for H/S credit)
220.105 or 220.106 Introduction to Fiction and Poetry I

Students wishing to use any other course to satisfy this writing requirement must have written permission (an email is acceptable) from their advisor.

Economics Requirement

To help the student gain an appreciation of the broad economic context in which he/she will operate, one calculus-based introductory course in economics, 570.334 *Engineering Microeconomics*, is required.

Distribution and Depth Requirements

Although not directly related to the major field of study, the Humanities and Social Science portion of the program is also of great importance in broadening the student's education and in stimulating the development of an inquisitive and critical mind. In order to best attain these objectives, four elective courses in Humanities and Social Science courses must be chosen. Two of these courses must be at the 300 level or higher. Environmental engineering majors are strongly encouraged to consider taking 570.404 and/or 570.406 as part of these requirements. With the approval of the student's advisor, intermediate level language courses may be taken to satisfy this depth requirement. Note that the Whiting School (and the Department) allow the first two semesters of any elementary course in a foreign language to count toward the fulfillment of the H/S requirement as long as both semesters are successfully completed.

Summary

In summary, the Environmental Engineering program requires a minimum of six full courses (18 credits) in Humanities and Social Sciences, one writing course (as defined above), one course in economics (570.334), and four additional Humanities and Social Sciences courses, two of which must be at the 300 level or higher.

DOUBLE-MAJORS AND MINORS

Information for Environmental Engineering Majors

Environmental Engineering majors may elect to double-major or to complete a minor from any department in the School of Engineering or the School of Arts and Sciences that offers one. Students wishing to pursue a double major should inform the Whiting School's Office of Academic Advising. It is the student's responsibility to ensure that all appropriate requirements are met (it is recommended that a faculty advisor from each major be asked to sign off on the student's planned academic program). Students wishing to pursue a minor should confer with the department through which the minor is offered to ascertain the exact requirements.

The minor in Entrepreneurship and Management focuses on business and management from a multidisciplinary viewpoint and is designed to provide Hopkins engineering students with the knowledge and skills to become leaders in technology companies. Students interested in the Entrepreneurship and Management minor should contact the Center for Leadership Education (http://web.jhu.edu/leadership or cle@jhu.edu) for more information. More traditional subspecialty minors are available through the departments of Civil Engineering, Computer Science, and Applied Mathematics and Statistics.

The Environmental Engineering Minor

Environmental engineering has become an important part of engineering practice in most engineering fields and across a professional spectrum from the private sector through governmental agencies to academia. An undergraduate minor in environmental engineering has been established to enable engineering students to pursue an interest in this field and to incorporate aspects of environmental engineering into their own careers in other engineering disciplines. Students in any undergraduate engineering major in the GWC Whiting School of Engineering are eligible for admission to the program, which is administered through the Department of Geography and Environmental Engineering (DoGEE). Students in undergraduate majors other than engineering can enroll in the Environmental Science minor, also offered by the Department of Geography and Environmental Engineering.

Each student in the Environmental Engineering Minor program will be assigned an advisor in the Department of Geography and Environmental Engineering to work with them in developing a program that meets the requirements for the minor that is consistent with the educational requirements of their major field of engineering study. Requirements of the Minor Program consist of (1) a set of "core" science and mathematics courses, already common to the civil and chemical engineering majors, (2) four required courses (total of 11 credits) in environmental engineering, and (3) two elective courses, one of which is taken at the freshman or sophomore level and the other of which is taken at the junior or senior level. Lists of the core courses, required courses, and approved elective courses are provided subsequently. Other electives may be considered, but are subject to specific approval by the minor advisor.

Students with a strong interest in Environmental Engineering may also wish to consider the Whiting School's Honors B.S./M.S.E. Program. Under this program, outstanding students completing ABET-accredited B.S. programs in engineering disciplines can apply for direct continuation into the M.S.E. Program in Environmental Engineering, which is administered by the Department of Geography and Environmental Engineering.

Below are the course requirements for the Environmental Engineering Minor. For further information, contact: Dr. William P. Ball, Coordinator, 301 Ames Hall (DoGEE) (bball@jhu.edu).

CORE COURSES (advanced placement credits and/or equivalent courses in other schools or departments are acceptable, subject to advisor approval)

110.108 Calculus I	4 credits
110.109 Calculus II	4
110.202 Calculus III	4
550.291 Linear Algebra and Differential Equations	4
030.101 Introductory Chemistry I	3
030.102 Introductory Chemistry II	3
030.105 Introductory Chemistry Laboratory	1
030.106 Introductory Chemistry Laboratory	1
171.101 General Physics I	4
171.102 General Physics II	4
173.111 General Physics Laboratory	1
173.112 General Physics Laboratory	1

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CURRICULUM (a total of 18 credits is required)

Required Courses (total of 12 credits)

570.301	(N,E), Environmental Engineering I-Fundamentals, 3 credits, fall
570.302	(N,E), Environmental Engineering II -Water and Wastewater Treatment, 3 credits, spring
570.304	(N,E), Environmental Engineering and Science Laboratory, 3 credits, spring
570.305	(N,E), Environmental Engineering Systems Design, 4 credits, fall

Elective Courses (total of 6 credits). One course from each of two groups is required.

Group A** - Introductory courses at the freshman and sophomore level. One course required.*

570.108	Introduction to Environmental Engineering
570.205	Ecology
570.239	Current and Emerging Environmental Issues
570.317	Paleoecology
570.328	Geography and Ecology of Plants
020.151	General Biology I
270.220	The Dynamic Earth: An Introduction to Geology
500.111	Energy and the Environment

Group B** - Engineering science courses that are developed for juniors and seniors, and also introductory graduate level courses. One course required. **Double counting of these courses with specified required courses in the student's major is not allowed.**

270.320	The Environment and your Health
570.353	Hydrology
570.411	Engineering Microbiology
570.420	Mechanics for Earth and Environmental Science
570.423	Principles of Geomorphology
570.431	Open Channel Hydraulics

570.432	Sediment Transport and River Mechanics
570.442	Environmental Organic Chemistry
570.443	Aquatic Chemistry
570.445	Physical/Chemical Processes in Environmental Engineering I
570.446	Biological Processes for Water and Wastewater Treatment
570.491	Hazardous Waste Management
030.201	Intermediate Organic Chemistry
030.204	Intermediate Chemistry
030.301	Physical Chemistry I
270.369	Introduction to Geochemistry
270.401	Geochemical Kinetics
270.410	Global Climate Change: Introduction
540.301	Chemical Kinetics and Reactor Design
540.303	Transport Phenomena I
550.310	Introduction to Probability and Statistics
560.435	Probability and Statistics in Civil Engineering

*Substitution for one required course may be possible under special circumstances, with explicit approval of the environmental engineering minor advisor.

**Additional course electives are possible but require approval of the environmental engineering minor advisor.

The Minor in Engineering for Sustainable Development

Engineers will be increasingly called upon to help devise solutions to the tremendous problems of poverty, inequality, and social and environmental dislocation that afflict major parts of the globe in the 21st century. Working as an engineer in this context involves negotiating highly complex social, economic and political realities and dealing with a wide range of institutions and actors, including national and local governments, multilateral lenders such as the World Bank, diverse non-governmental organizations (NGOs) and local communities. It also increasingly involves working in interdisciplinary teams with social scientists, public health and medical workers, humanitarian aid workers, bankers, politicians and the like. "Sustainable" development implies a development path that is socially equitable, culturally sensitive, and environmentally appropriate over a multi-generational time frame.

The Minor in Engineering for Sustainable Development exposes engineering students to some of the key issues related to development, methods of information-gathering in diverse and difficult settings, and working effectively with non-engineers on complex problems. We begin with a one-semester core course that surveys the various issues involved, followed by an individually-designed but coherent program organized around a particular theme, disciplinary approach or region of the world. We conclude with a one-semester seminar in which students come together and share their experiences and insights from their various program trajectories.

The Program: Structure and Content

Students pursuing the minor are required to take seven courses. The core course is 570.110 Introduction to Engineering for Sustainable Development. Five additional courses will be selected in a program devised in consultation with the Minor advisor. Students are also required to take 570.4xx Seminar in Engineering for Sustainable Development: Theory, Practice, Experience after completing the other requirements for the minor (under development).

Of the five additional courses:

- Three must be grouped around a specific theme, region or within a specific discipline. Themes might include, for example, public health, environment, or economic development. Regions include Africa, Latin America or Asia. Disciplinary concentrations might be in Anthropology, Economics, Geography, History, Political Science, Public Health or Sociology.
- Three of the courses must be at the 300-level or above.
- One of the courses must cover methods for gathering and evaluating information in a development context. Examples include:

  070.319 The Logic of Anthropological Inquiry

  070.219 Anthropology and Public Action

  070.347 Discourse Analysis: Stories and their Structures

  280.345 Biostatistics in Public Health

  280.350 Introduction to Epidemiology

  230.202 Research Methods for the Social Sciences

All courses must be completed with a grade of C- or better to qualify for the minor. At least two semesters of foreign language study are strongly recommended but not required. Students who participate in a Study Abroad program for a semester can, with the minor advisor's consent, use this experience to count in place of one of the required courses.

The value of this program will be enhanced by some form of hands-on experiential project, whether at a field site in a developing country, in support of field-workers in other divisions of the university or in distressed communities in Baltimore. This experience is not required for the minor. It might take one of the following forms:

- Field work in collaboration with Engineers Without Borders.
- Providing technical support to "clients" at Hopkins (for example, at the School of Public Health) who are engaged in field projects in developing countries. This might involve, for example, developing dedicated software for data management, devising robust and easy-to-use test kits for environmental toxins or medical conditions, or facilitating interactive analysis and project planning between researchers in Baltimore and the field personnel.
- Participating in programs being developed by the JHU Center for Social Concern, with its growing service learning component. This would allow students to work on projects in Baltimore which offers an ample field for identifying and responding to social and environmental problems.

Eligibility

The minor is open to undergraduates in any of the engineering disciplines in the Whiting School of Engineering. Students in Arts & Sciences may also pursue the minor with the permission of the program director.

For further information, contact: Dr. Erica Schoenberger, Program Director, 501 Ames Hall, ericas@jhu.edu, 410-516-6158.

Minor in Environmental Sciences

The environmental sciences minor has been developed to encourage and facilitate studies in environmental sciences by students completing degrees in the other science and engineering disciplines. The environmental sciences (ES) minor requires:

• completion of a set of courses in the core sciences,
two introductory courses dealing with the environment, and
• three or more upper-level environmental sciences courses, as described below.

Core Sciences (ES Minor)

Because of the interdisciplinary nature of environmental science, it is important that professionals from various areas of expertise acquire a common language and set of core concepts to make discussion and cooperation possible. The following courses represent the minimum set of requirements:

• **Mathematics (12 credits)**
110.108 Calculus I
110.109 Calculus II

At least one of these four courses:

110.201 Linear Algebra
110.202 Calculus III
110.302 Differential Equations with Applications
550.291 Linear Algebra and Differential Equations

- **Biology (3 credits)**
  One course, such as
  020.151 General Biology

- **Physics (10 credits)**
  171.101 Physics I
  171.102 Physics II
  173.111 General Physics Lab I
  173.112 General Physics Lab II

- **Chemistry (13 credits)**
  030.101 Intro Chemistry
  030.104 Intro Organic Chemistry
  030.105 Intro Chemistry Lab
  030.106 Intro Chemistry Lab

Environmental Sciences:
Students must take two introductory courses dealing with the environment and three or more of the upper-level environmental science courses on the following lists:

- Introductory Courses (6 credits)

570.110 Introduction to Engineering for Sustainable Development
570.205 Ecology
570.239Current and Emerging Environmental Issues

270.110 Freshman Seminar: Sustainable and Non-Sustainable Resources
270.220 The Dynamic Earth: An Introduction to Geology
270.221 The Dynamic Earth Lab

- **Upper-Level Courses (9 credits)**
  570.239 Current and Emerging Environmental Issues
  570.301 Environmental Eng I: Water and Wastewater Treatment
  570.302 Environmental Eng II: Water and Wastewater Treatment
  570.317 Paleoecology
  570.328 Geography and Ecology of Plants
  570.353 Hydrology
  570.411 Environmental Microbiology
  570.420 Mechanics for Earth and Environmental Science
  570.423 Principles of Geomorphology
  570.424 Air Pollution
  570.431 Open-Channel Hydraulics
  570.432 Sediment Transport and River Mechanics
  570.441 Environmental Inorganic Chemistry
  570.442 Environmental Organic Chemistry
  570.443 Aquatic Chemistry
  570.445 Physical and Chemical Processes in Environmental Eng I
  570.446 Biological Processes for Water and Wastewater Treatment
  570.460 Environmental Colloidal Phenomena
  570.465 Water Resource Development**:** History and Principles
  570.491 Hazardous Waste Engineering and Management
  270.302 Aqueous Geochemistry
  270.321 Intro Oceanography
  270.350 Sedimentary Geology
  270.311 Geobiology
  270.313 Isotope Geochemistry
  270.314 Field Course in Soil Formation
  270.369 Geochemistry of the Earth and Environment
  270.375 Groundwater
  270.394 Global Geochemical Cycles and Climate Change

Pairing a Major with the ES Minor

Many of the most creative and productive advances in environmental sciences in recent years have come from scientists trained in traditional disciplines (biology, chemistry, geology, physics, and engineering) who have devoted themselves to the study of environmental problems. Completion of the degree requirements of a traditional discipline provides depth and rigor that, when supplemented with additional academic training in environmental science, can be applied to professional work in a variety of environmental subjects, as the following examples show:

Biological Processes: Response of ecosystems to change, microbial degradation of pollutants, biogeochemical cycling of greenhouse gases. Illustrative majors: Biology, Biomedical Engineering, Biophysics, Biochemical Engineering.
Physical Processes: Erosion of hillslopes, rivers, and coastlines; sediment production, transport, and fate; groundwater, movement of contaminant plumes; oceanography; atmospheric physics; aerosol formation; global warming. Illustrative majors: Civil Engineering, Chemical and Biomolecular Engineering, Mechanical Engineering, Physics, Earth and Planetary Sciences.
Environmental Chemistry: Environmental fate of pollutants, water and waste water treatment, geochemistry, atmospheric chemistry, ozone depletion, acid rain. Illustrative majors: Chemistry, Chemical and Biomolecular Engineering, Earth and Planetary Sciences, Materials Science and Engineering.
Environmental Systems: Environmental modeling, risk assessment, environmental systems design, pollution control strategies. Illustrative majors: Civil Engineering, Applied Mathematics and Statistics.

Faculty Advising:
A faculty advisor is assigned to each student in the environmental sciences minor program to assist in planning his/her academic program and to approve the choice of courses to satisfy the minor. Faculty advisors are available in the following areas:

Biological Processes: Edward J. Bouwer
Physical Processes: Peter R. Wilcock
Environmental Chemistry: Alan T. Stone
Environmental Systems: Ben Hobbs
Human Geography: Erica J. Schoenberger

For further information, contact Professor Peter Wilcock, EES Coordinator 410-516-5421, wilcock@jhu.edu, or Adena Rojas, Senior Academic Program Coordinator, 410-516-5533, arojas@jhu.edu.

Undergraduate Minor in Geography and Environmental Engineering

Name: _____ Graduation Date: _____

Degree: _____

Minor: Select one: environmental engineering, engineering for sustainable development, environmental science)

Faculty Advisor: _____

Course #	Course Title	Grade	Sem/Yr	Cr/Hr
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Students are only allowed to apply up to two classes with a "C" towards their degree

_____ has fulfilled the requirements for a Geography undergraduate degree in the Johns Hopkins University Department of Geography and Environmental Engineering.

Advisor's Name (please print): _____

Advisor's Signature:_____

Department Chair's Name: _____

Department Chair's Signature:_____

THE CONCURRENT 5-YEAR BACHELOR'S/MASTER'S PROGRAM

The Department of Geography and Environmental Engineering offers a concurrent five-year B.S/M.S. and B.S./M.S.E. program. The department strongly prefers applications to be submitted by the end of the fall semester of the junior year.

To apply for admission, the student must submit an online application at http://gradadmin.as.jhu.edu/graduateapplication/default.cfm. In addition, the student will need to present a statement of purpose, three letters of recommendation, and college transcripts.

Upon acceptance into the program, students will be asked to develop an outline of their proposed academic program with their advisor. Please visit http://eng.jhu.edu/wse/page/concurrent contact your advisor if you have questions or would like to consider application to the program.

FREQUENCY OF COURSE OFFERINGS

Some courses are offered exclusively in specific semesters, and sometimes in alternating years. Below is the standard timeframe of course offerings. **These offerings are subject to change without notice, and future "next offered" dates are tentative.** Please confirm these offerings with your advisor when planning your course schedule. Please consult with your advisor for intervals of courses not listed here.

Graduate courses (570.6xx), which are not shown below, can be taken by seniors with permission of the instructor. Note: In order to take a graduate level course, all undergraduates and concurrent BA/MA and BS/MS students must obtain an instructor's signature and submit that signature to the Registrar's Office unless otherwise noted in ISIS.

500 level courses: register in person. A signature from a full-time Homewood faculty sponsor is required.
600 level and above: all undergraduate and concurrent BA/MA and BS/MS students must obtain an instructor's signature and submit that signature to the Registrar's Office unless otherwise noted in ISIS.
You can add Undergraduate Permission Required Courses: if the course is permission required, you must obtain permission from the instructor prior to adding and then you may add online. If you add without receiving permission, you run the risk of being removed from the course. You DO NOT need to bring that signature to the Registrar's Office.
For signature requirements, go to www.advising.jhu.edu and click on Academic Manual Policies and choose the Registration option.

COURSE	INTERVAL OF OFFER	NEXT OFFERED
570.108 Introduction to Environmental Engineering	Fall/Summer	Fall
570.109 Environment and Society: Towards Sustainability	Fall	Fall
570.205 Ecology	Fall	Fall
570.210 Introduction to Computation/Mathematical Modeling	Spring	Spring
570.239 Current and Emerging Environmental Issues	Spring	Spring
570.301 Environmental Engineering I: Fundamentals	Fall	Fall
570.302 Environmental Engineering II: Water/Wastewater	Spring	Spring
570.304 Environmental Engineering and Science Lab	Spring	Spring
570.305 Environmental Engineering Systems Design	Fall	Fall
570.317 Paleoecology	Spring/Alt Yrs	TBA
570.328 Geography and Ecology of Plants	Spring	Spring
570.334 Engineering Microeconomics	Fall	Fall
570.353 Hydrology	Fall	Fall
570.395 Principles of Estuarine Environment	Fall/Alt Yrs	TBD
570.404 Political Ecology	Fall	TBD
570.406 Environmental History	Fall	Fall
570.409 Facility Siting Models	Fall/Alt Yrs	TBD
570.419 Environmental Engineering Design I	Fall	Fall
570.420 Mechanics for Earth and Environment Science	Fall	
570.421 Environmental Engineering Design II	Spring	Spring
570.423 Principles of Geomorphology	Spring	TBA
570.424 Air Pollution	Spring/Alt Yrs	TBA
570.427 Natural Resources, Society, and Environment	Fall	TBA
570.429 Surface Effects in Technological Processes/Materials	Fall	TBA
570.431 Open-Channel Hydraulics	Spring/Alt yrs	TBA
570.432 Sediment Transport and River Mechanics	Spring/Alt Yrs	TBA
570.441 Environmental Inorganic Chemistry	Spring/Alt Yrs	Spring
570.442 Environmental Organic Chemistry	Fall	Fall
570.443 Aquatic Chemistry	Fall	Fall
570.445 Physical/Chemical Processes for Water and Wastewater Treatment	Fall	Fall
570.446 Biological Processes for Wastewater Treatment	Spring	Spring
570.448 Physical/Chemical Processes in Environmental Engineering II	Spring	Spring
570.452 Exper. Methods in Environmental Engineering and Chemistry	Spring	Spring
570.460 Environmental Colloidal Phenomena	Spring	Spring
570.470 Applied Economics and Finance	Fall	Fall
570.487 Futures Market Research	Fall	Fall
570.490 Solid Waste Engineering Management	Fall	Fall
570.491 Hazardous Waste Management	Spring	Spring
570.492 Department Seminar	Fall/Spring	Fall
570.493 Economic Foundations for Public Decision Making	Fall	Fall
570.494 Ecosystem Management Models	Fall	TBA
570.495 Mathematical Foundations for Public Decision Making	Fall	Fall
570.496 Optimization Models in Environmental Systems	Spring/Alt Yrs	Spring
570.497 Risk and Decision Analysis	Fall	Fall
570.501 Undergraduate Research		Fall
570.505 Independent Study		Fall

ENVIRONMENTAL ENGINEERING CHECKOUT SHEET updated 8/3/2013

Note: Environmental Engineering Majors must complete and obtain their advisor's signature on a checkout sheet at the beginning of each semester. Submit signed check out sheets to DoGEE in person (Ames Hall 313 to the Sr. Academic Program Coordinator) or via email (dogee@jhu.edu) prior to registering each semester.

Student:_____ Class of:_____ Current Year/Semester:_____

Focus Area:_____Advisor's Name/Signature:_____Date: _____

		Cred	Grde	Sem			Cred	Grde	Sem
	Basic Science					**Required Env. Eng.**			
171.101	General Physics I	4			570.239	Current/Emerg Env Issues	3		
173.111	General Physics Lab. I	1			570.301	Env Eng I: Fundamentals	3		
171.102	General Physics II	4			570.302	Env Eng II: Water/Wastew.	3		
173.112	General Physics Lab. II	1			570.304	Env Eng and Science Lab	3		
030.101	Intro Chemistry I	3			570.353	Hydrology	3		
030.105	Intro Chemistry Lab I	1							
030.102	Intro Chemistry II	3					**15**		
030.106	Intro Chemistry Lab II	1				**Env. Eng. Electives**			
570.205	Ecology	3			(F1)*		3		
.	Biology	3			(F1)*		3		
					(F2)*		3		
	(24 or 25 credits)	**24**			(F3)*		3		
	Mathematics								
110.108	Calculus I	4					**12**		
110.109	Calculus II	4				**Technical Electives**			
110.202	Calculus III	4					3		
550.291	LA/DE	4					3		
___.3__	Statistics	3					3		
							3		
		19							
	H & S Electives						**12**		
570.334	Engineering Microecon.	3				**General Engineering**			
	Writing	3			570.108	Introduction to Environ. Engr.	3		
		3				Computing	3		
		3				Thermodynamics	3		
___.3__		3			570.351	Intro. To Fluid Mechanics	3		
___.3__		3				Statics and Mechanics of Mat.	4		
		18					**16**		
	Design Exp/Eng Lab								
570.305	Env Eng Systems Design	4							
570.419	Design/Synth in Env Eng I	2							
570.421	Design/Synth in Env Eng II	3							
		9							

Sr. Academic Prog. Coordinator Signature:_____Date: _____

Dept Chair's Signature:_____Date: _____

***Students must select 2 courses from one focus area and one course from each of the two other Focus Areas (F2, F3). See Environmental Engineering Section in the Undergraduate Advising Manual**

Whiting School of Engineering

Substitution/Exception/Waiver Form

Directions: Any courses relating to, exception made to, or waiver of published degree guidelines must be approved by use of this form.

Please state the substitution, waiver, or exception requested in the box below:

_____	_____	_____
Student's Signature	Printed Name	Date
_____	_____	_____
Faculty Advisor's Signature	Printed Name	Date

One additional signature is required.

- Substitutions, exceptions, or waivers pertaining to ***courses in the major or technical electives*** must be approved by the ***Department Chair*** of the program in which the student is enrolled.
- Substitutions, exceptions, or waivers pertaining to ***all other courses*** must be approved by the ***Engineering Advising Office*** in Shaffer 103.

_____	_____	_____
Department Chair or Engineering Advising Office	Printed Name	Date

DIRECTORY OF FACULTY, STAFF, AND OTHER CONTACTS

DoGEE FACULTY

Name	Telephone	E-mail	Office
Dr. Hedy Alavi Senior Lecturer, Assistant to the Dean for International Programs	410-516-7091	alavi@jhu.edu	215 Ames
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Professor Edward Bouwer (Chair)	410-516-7437	bouwer@jhu.edu	312 Ames
Professor Grace Brush	410-516-7107	gbrush@jhu.edu	303 Ames
Assistant Professor Kai Loon Chen	410-516-7095	kailoon.chen@jhu.edu	308 Ames
Professor Hugh Ellis	410-516-6537	hugh.ellis@jhu.edu	210 Ames
Assistant Professor Seth Guikema	410-516-6042	guikema@jhu.edu	205 Ames
Assistant Professor Ciaran Harman	410-516-7102	charman1@jhu.edu	306 Ames
Professor Ben Hobbs	410-516-4681	bhobbs@jhu.edu	208 Ames
Assistant Professor Catherine Norman	410-516-5031	norman@jhu.edu	211 Ames
Professor A. Lynn Roberts	410-516-4387	lroberts@jhu.edu	206 Ames
Professor Erica Schoenberger	410-516-6158	ericas@jhu.edu	501 Ames
Professor Alan Stone	410-516-8476	astone@jhu.edu	304 Ames
Professor Peter Wilcock	410-516-5421	wilcock@jhu.edu	310 Ames

DoGEE CLASS ADVISORS **(For more specific details about your advisor, please see your ISIS account.)**

Class of	Advisor
2017 (Freshman)	Edward Bouwer, Ben Hobbs
2016 (Sophomores)	Alan Stone, Lynn Roberts, Hugh Ellis
2015 (Juniors)	Seth Guikema, Kai Loon Chen, Erica Schoenberger, Grace Brush
2014 (Seniors)	Peter Wilcock, Ciaran Harman, Bill Ball

DoGEE ADMINISTRATIVE STAFF

Name	Telephone	E-mail	Office
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TBA Budget Analyst	410-516-0718		313 Ames
TBA Administrative Coordinator	410-516-7092		313 Ames
Shahin Zand Academic Coordinator (IGERT/PIRE)	410-516-5176	zand@jhu.edu	239 Ames

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