

Environmental Engineering & Science

Purpose

Program Educational Objective: The educational objective of the environmental engineering and science (GES) program is that within a few years of program completion, graduates, who would be serving as DoD officers and career professionals, will demonstrate that they can apply the principles of environmental engineering and science (encompassing air, water, soil media) to successfully accomplish their future duties across the spectrum of DoD environmental consulting and management duties. These abilities may be validated through voluntary professional certification, as appropriate (e.g., PE, CEM, BCEEM, QEP).

Program Outcomes: Upon graduation, students will be able to:

1. Conduct and present methodological research to solve problems and support decisions.
2. Critically analyze studies within the current literature.
3. Demonstrate an in-depth knowledge within a chosen environmental emphasis area.

The Graduate School of Engineering and Management, Department of Systems and Engineering Management offers the Master of Science degree with major in Environmental Engineering and Science (GES). The GES Program was designed to provide DoD career professionals with relevant graduate education in the principles of environmental engineering and science. This program was developed considering guidelines established by the Accreditation Board for Engineering and Technology and subject areas from the Professional Engineering Exam for Environmental Engineering. Students matriculating with an Engineering Accreditation Commission (EAC) of ABET accredited undergraduate degree will receive the degree Master of Science in Environmental Engineering and Science upon successful completion of all graduation requirements. Those students who do not have an EAC of ABET accredited undergraduate degree will receive the degree Master of Science.

The GES program was also developed in coordination with an Industrial Hygiene Degree previously offered at the Uniformed Services University for the Health Sciences (USUHS) in Bethesda, MD and now offered at AFIT. Both programs were motivated by a request from the AF Bioenvironmental Engineering (BEE) career field. This program was offered for the first time in the Fall of 2003 and capitalizes on existing coursework and research thrusts present in several AFIT departments. The core curriculum includes course offerings in statistics, chemistry, risk assessment, chemical fate and transport in the environment, and environmental sampling, along with design classes in air, water, and solid waste pollution control.

Admission Standards and Procedures

The general requirements for admission to the Master of Science program in Environmental Engineering and Science are:

- 1. A Bachelor's degree from an ABET accredited engineering program or a B.S. degree in a science related to environmental science, such as physics, biology, chemistry or industrial hygiene.**
- 2. Math courses including calculus through Ordinary Differential Equations.**
- 3. A cumulative undergraduate GPA of 3.0 (on a 4.0 scale), 1100 GRE combined verbal and quantitative score.**

NOTE: Deficiencies in the above areas may be waived or corrected through additional coursework on a case-by-case basis by the Department of Systems and Engineering Management.

Curriculum Description

The GES program is conducted in six academic quarters and a short term (18 total months, beginning in September) for full time students. The short term program provides an orientation to the school and curriculum, a review of basic mathematics and chemistry, an introduction to the computer systems serving AFIT, and an overview of the environmental engineering and science program.

The 50-quarter hour (QH) degree requirements for the Environmental Engineering and Science degree will include specified environmental engineering and department core classes plus a specialty sequence, statistics course, thesis, and electives. The specialty sequence is intended to develop students' in-depth knowledge of a specific area of environmental engineering and science. A 12 QH thesis with oral defense will also be required. The thesis must address a real-world problem in an engineering or environmental science. Principal purposes of the thesis are to demonstrate the student's ability to integrate concepts and techniques acquired through course work and to demonstrate scholarly pursuit of a focused research question, all of which leads to enhanced capability of the graduate to pursue technical problems creatively and effectively across a broad spectrum of areas. The additional coursework (e.g., in Environmental Microbiology, Environmental Toxicology, Nuclear/Chemical Agent Effects), is indicated on the six-quarter program full time students plan and are required for students sponsored by the USAF BEE career field. Electives are offered in addition to strict degree requirements and broaden the student's horizons and/or provide more in-depth knowledge in a specific area of interest. In addition to degree requirements, all DoD-sponsored full-time students must complete an average of 12 credit hours per quarter over the total number of quarters in residence, for a total of 72 credit hours.

Course Sequence

GES 12M Graduate Environmental Engineering and Science Program Guide (Suggested 6 quarter program for full-time quota student)

<u>SHORT FALL 10</u>		<u>Credit Hours</u>
ENVR 002	Excel Solver/Math Review	0
CHEM 000	Chemistry Review	0
ENVR 001	Intro to GES/GIH	0
COMM 310	Fundamentals of Written Communication	0
MATH 002	Calculus Review	0
<u>FALL 10</u>		
STAT 525 ¹	Statistics I	4
ENVR 550	Environmental Systems Engineering	4
ENVR 501	GEM/GES/GIH Seminar	0
ENVR 651 ¹	Environmental Risk Analysis	3
ENVR 575	Applied Environmental Health	<u>3</u>
		14
<u>WINTER 11</u>		
ENVR 643 ¹	Environmental Transport Processes	4
EMGT 502	Research Perspectives	1
XXXX xxx	Elective/Sequence ²	3
ENVR 528	Environmental Physiology and Toxicology	4
ENVR 556	Sustainable Life Cycle Design	<u>3</u>
		15
<u>SPRING 11</u>		
ENVR 661 ¹	Sampling and Analysis	4
ENVR 503	GES/GIH Critical Review of Literature Seminar	0
ENVR 624 ¹	Water Chemistry for Env. Engineers	4
XXXXxxx	Elective/Sequence ²	3
XXXXxxx	Elective/Sequence ²	<u>3</u>
		14
<u>SUMMER 11</u>		
ENVR 535	Solid & Hazardous Waste Management	3
ENVR 645 ¹	Water/Wastewater Treatment Design	4
ENVR 625 ³	Environmental Microbiology	4
XXXX 799 ¹	Thesis	3
ENVR 504	GES/GIH Colloquium	<u>0</u>
		14
<u>FALL 11</u>		
XXXX 799 ¹	Thesis	6
ENVR 505	GEM/GES/GIH Colloquium	0
ENVR 532 ¹	Air Resources Management	<u>3</u>
		9

WINTER 12

XXXX 799 ¹	Thesis	3
ENVR 628	Physiologic Effects of NBC Agents	3
XXXXxxxx	Elective/Sequence ²	<u>3</u>
		9
		75 Total QH

¹ Required for degree, 72 credits required for full time quota

² Three focus sequence classes required

³ Students taking those sequences that include ENVR 625 as a component course have an opportunity to take an additional elective course

Water Specialty Sequence

This Water Specialty sequence would provide depth for students in water resource related areas such as groundwater remediation, constructed wetlands, and water or wastewater treatment.

		<u>Credit Hours</u>
ENVR 625	Environmental Microbiology (Summer)	4
ENVR 640	Groundwater Hydrology and Contam Xport (Spring)	3
ENVR 534	Ecology, Limnology, Natural Resources (Spring)	3

Atmospheric Science Specialty Sequence

The atmospheric science sequence prepares the student for more in depth analysis of air pollution and air pollution control through examination of the physico-chemical interactions in the atmosphere.

		<u>Credit Hours</u>
ENVR 511	Environmental Management & Policy (Winter)	3
METG 650	Atmospheric Modeling for Engineers (Summer)	4
METG 511	Atmospheric Physics for Engineers (Winter)	4

Environmental Planning Specialty Sequence

The Environmental Planning Specialty Sequence would prepare students in areas related to environmental planning such as sustainable energy, land use, species protection, ecosystem modeling, and environmental management.

		<u>Credit Hours</u>
ENVR 511	Environmental Management & Policy (Winter)	3
EMGT 530	Engineering Econ Decision Analysis (Summer)	3
EMGT 642	System Dynamics Modeling (Winter)	4

Remediation Management Sequence

The Remediation Management Sequence would provide students with an understanding of the processes that impact the fate and transport of subsurface contaminants, as well as the physical, chemical, and biological processes implemented by engineered remedial technologies, in order to manage contaminated soil and groundwater remediation under economic and regulatory constraints.

		<u>Credit Hours</u>
ENVR 640	Groundwater Hydrology and Contam Xport (Spring)	3
ECON 530	Engineering Econ Decision Analysis (Summer)	3
ENVR 772	Remediation Design and Management (Fall)	3

Biological Weapons Effects

The Biological Weapons Effects Sequence would provide students with an understanding of the underlying science and technology in biological weapons design and deployment, human effects from exposure to biological agents and current issues regarding terrorism to include the legal framework of response within CONUS and current treatment and prophylaxis concerns for both military and civilian responders and victims.

		<u>Credit Hours</u>
BIOL 597	Biological Weapons Technology (Fall)	4
ENVR 628	Physiologic Effects of NBC Agents (Winter)	3
ENVR 625	Environmental Microbiology (Summer)	4

Selection of electives will be determined by interaction between the advisor and student. Whenever possible, electives should support thesis work or broaden the student's knowledge base. All GES students are strongly recommended to take ENVR 511 as an elective if not included in their focus sequence. Students also may take electives from Wright State University that support their area of emphasis.