

school of sustainable engineering and the built environment

civil, environmental and sustainable
engineering



Environmental Engineering is an interdisciplinary field that synthesizes knowledge from a wide range of subjects. People who have careers in environmental engineering often study, provide solutions and implement strategies concerning the quality of air, water and land resources; transport, use and disposal of hazardous wastes; water and wastewater treatment; and water reuse. Environmental engineers lead and are involved in multidisciplinary projects addressing complex issues and changing technologies that are required for sustainable development.

The graduate curriculum in the Civil, Environmental and Sustainable Engineering (CESE) program in the School of Sustainable Engineering and Built Environment (SSEBE) at Arizona State University (ASU) is designed to provide a strong foundation in physical, chemical, and microbiological principles, but remains flexible to meet changing needs within the field.

The ASU environmental engineering program has two general themes: First, much of the ongoing research focuses on or involves consideration of environmental processes occurring in arid regions of the world. Arizona has a semi-arid climate, and much of the population growth world-wide is occurring in similar climates. Unique aspects of air and water pollution and sustainable development in these climates are a strong organizing theme for research, seminars, and course work. The underlying fundamentals of semi-arid climate environmental engineering are universal to any climate.

Second, multidisciplinary sustainability-related activities via collaborative projects, courses, and seminars are strongly encouraged. The Environmental Engineering group has strong working relationships with microbiologists, plant biologists, ecologists, chemists, geologists, and social scientists around campus. Many of these collaborations address societal issues associated with developing urban environments.

While these two themes are clearly present in our CESE program at ASU, the graduate program receives national funding for a wide range of educational and research endeavors. Some of the exciting areas of ongoing research are related to the following:

- (1) Sustainable Engineering of Urban Systems
- (2) Environmental Biotechnology
- (3) Environmental Nanotechnology

environmental engineering

ENVIRONMENTAL ENGINEERING FACULTY

- [Morteza Abbaszadegan](#), Professor
- [Braden Allenby](#), Professor
- [Jean Andino](#), Associate Professor
- [Peter Fox](#), Professor (Specialty Area Coordinator)
- [Rolf Halden](#), Professor
- [Paul Johnson](#), Professor
- [Rosa Krajmalnik-Brown](#), Assistant Professor
- [Amy Landis](#), Assistant Professor
- [Bruce Rittmann](#), Professor
- [Paul Westerhoff](#), Professor
- [Mikhail Chester](#), Assistant Professor
- [Thomas Seager](#), Associate Professor
- [Enrique Vivoni](#), Associate Professor

LIST OF COURSES

The Environmental Engineering graduate program includes three sub-disciplines:

- [Water Quality Process Engineering](#)
- [Environmental Microbiology](#)
- [Air Quality Engineering](#)

The specialty areas were developed to aid students in selecting a curriculum and in organizing research activities. There are overlaps between the specialty areas. Students are required to develop a Plan of Study (POS) which includes a minimum of four (4) of the indicated seven (7) classes below:

- CEE 561 Physical-chemical Treatment of Water
- CEE 562 Environmental Biochemistry and Waste Treatment
- CEE 563 Environmental Chemistry Laboratory
- CEE 564 Contaminant Fate and Transport
- CEE 567 Environmental Microbiology
- CEE 569 Air Quality Engineering
- CEE 582 Industrial Ecology and Design for Sustainability

Students are encouraged to take additional classes in the four specialization areas as described below. Taking classes offered in different departments is encouraged for a multidisciplinary education. Students shall have their advisor approve the students program of student and registration of classes each semester.

A graduate **Environmental Engineering**

Seminar Series (CEE 591) is organized every semester, and can be taken for credit towards your degree. This brown-bag forum brings in academic, industry, consulting, government, and student speakers each week. Students will be exposed to possible careers in Environmental Engineering and learn about state-of-the-art research and design through these seminar series. Additional seminars are offered across departments at ASU, and can be taken for course credit. Students are allowed to take CEE 591 three times for credit (the equivalent of one 3-credit course).

It is important for all doctoral students to read the [Civil, Environmental and Sustainable Engineering Ph.D. program manual](#).

M.S. PROGRAM

The advisor in consultation with the student, will establish a Graduate Supervisory Committee (GSC). The GSC shall be composed of a minimum of three faculty with at least two being tenure-track CESE faculty. The participation of individuals from institutions external to ASU is encouraged. The advisor shall serve as the chair of the GSC, and must be a tenure-track faculty in the Environmental group. The Plan of Study (POS) must be in accordance with Graduate College and Civil, Environmental and Sustainable Engineering Program requirements. This typically includes 24 credits of classwork, including at least four of the core graduate environmental classes, plus 6 credits of thesis CEE 599. CEE 590 (Reading and Conference) may be taken for no more than 3 credits. CEE 591 may be taken three times for credit.

M.S.E. PROGRAM

The Graduate Supervisory Committee (GSC) shall consist of all tenure-track Environmental faculty. The advisor shall serve as the chair of the GSC.

The Plan of Study (POS) must be in accordance with Graduate College and Civil, Environmental and Sustainable Engineering Program requirements. This includes 30 credits of classwork, including at least four of the core graduate environmental classes. CEE 590 (Reading and Conference) may be taken for no more than 3 credits. CEE 591 may be taken three times for credit.

- A final written comprehensive exam will be administered by the Environmental Group twice per year, usually the last Friday of classes during the regular fall and spring semesters. The exam is intended to demonstrate proficiency in 4 of the 7 core class subjects. Students will be given four hours to complete the exam and are expected to spend roughly one hour per core subject area. Students will be able to select at the time of the test which 4 core class subject areas will be graded. Only 4 subject areas will be graded. The exam is closed book. The exam will be graded by the Environmental faculty and a pass/fail decision made as a collective group. A student who fails the comprehensive exam the first time may petition to retake the exam once more no sooner than 90 days after the first exam and no later than one year. A student must be registered for at least one credit every fall and spring until they are officially completed with their degree and pass the comprehensive exam.

LIST OF COURSES

Water Quality Process

Engineering is a specialization focused on training graduate students for a professional engineering degree and employment with consulting engineers, municipalities/government, industry, academia, and advanced research opportunities.

Areas of water treatment, wastewater treatment, and groundwater remediation are emphasized. Related class work includes:

CEE 440/598 Engineering Hydrology
CEE 441/598 Water Resources Engineering
CEE 466/598 Sanitary Systems Design
CEE 540 Groundwater Hydrology
CEE 541 Surface Water Hydrology
CEE 542 Water Resources Systems Planning
CEE 543 Water Resources Systems
CEE 545 Foundations of Hydraulic Engineering
CEE 546 Free Surface Hydraulics
CEE 548 Sedimentation Engineering
CEE 560 Soil and Groundwater Remediation
CEE 565 Modeling and Assessment of Aquatic Systems
CEE 566 Industrial/ Hazardous Waste Treatment
CEE 567 Environmental Microbiology
CEE 568 Advanced Environmental Chemistry
CEE 598 Unit Operations
CEE 598 Water Reuse and Reclamation
CEE 598 Sustainability Engineering

Related class work in other departments:

CHE 475 Biochemical Engineering
CHE 533 Mass Transport Processes
CHE 544 Introduction to Chemical Reactor Design
CHE 527 Applied Mathematics for Chemical Engineers
CHM 424 Separation Methods and Quantitative Organic Analysis
CHM 581 Geochemistry
ASE 500 Statistics for Engineers
ERS 485 GIS in Natural Resources
GLG 598 Chemical Hydrogeology
GLG 598 Isotope Hydrogeology
GEO 471 Geographical Information Systems
IEE 569 Advanced Statistical Methods
IEE 572 Design of Engineering Experiments
GPH 412 Physical Climatology
GPH 414 Climatic Analysis
GPH 511 Fluvial Processes

LIST OF COURSES

Air Quality Engineering specialization focuses on the sources, fate, effects and control of air pollutants. For example, research emphasizes the composition of aerosol particles which affect human health, global climate, urban haze, and the fate and transport of pollutants. Students are prepared for careers in air quality management and atmospheric science research positions. Air quality management positions are in consulting firms, manufacturing companies, and government. Atmospheric science research positions are in academic, national, and industrial laboratories. An interdisciplinary certificate program in Atmospheric Science <http://geoplan.asu.edu/atmocert> offers students a coherent curriculum in atmospheric dynamics, physics, and chemistry.

CHE553/CEE598: Air Quality Engineering
CEE598/CHE598: Advanced Atmospheric Chemistry
GPH414/598: Climate Change
GPH474/598: Dynamic Meteorology I
GPH475/598: Dynamic Meteorology II
GPH412/598: Physical Climatology
MAE591: Geophysical Fluid Dynamics

LIST OF COURSES

Environmental Microbiology at ASU has a particular emphasis in applied environmental microbiology. Employment possibilities include consulting engineering, municipalities/government, industry, and advanced research opportunities. Areas of water treatment, wastewater treatment, novel biological technologies are emphasized. In addition to the research conducted in the school, microbiology-related research is also conducted at the Biodesign Institute (<http://www.biodesign.asu.edu/>). Related class work includes:

PLB 430 Statistical analysis in environmental science
MIC 470/598 Bacterial Diversity and Systematics
MIC 445/446 Techniques in Molecular Biology/Lab
GLG/MIC 461 Geomicrobiology
GLG 470 Hydrogeology
CHM/GLG 481 Geochemistry
ERS 311 Applied Ecology
ERS 333 Water Resources Management
ERS 465 Surface Water Quality
ERS 486 Remote Sensing in Environmental Resources
CEE 441 Water Resources Engineering
CEE 560 Soil and Ground Water Remediation
CEE 598 Advanced Environmental Microbiology/Biotechnology
BIO 524 Ecosystems
BIO 566 Environmental Physiology
BIO 598/598 Bioimaging /Lab
PLB 320/BIO 319 Environmental Science
BIO 426 Limnology