GEOGRAPHY AND ENVIRONMENTAL ENGINEERING, MASTER OF SCIENCE IN ENGINEERING

The Geography and Environmental Engineering, Master of Science in Engineering (MSE) is designed to prepare students with an ABET-accredited undergraduate engineering degree, or equivalent, to enter the workforce as leaders in the field. Students have five tracks to choose from, each with unique curricular requirements.

M.S.E. Tracks

CONTAMINANT FATE AND TRANSPORT
Emphasizes understanding the physical, chemical, and biological phenomena that affect the movement and transformation of pollutants in the environment.

ENVIRONMENTAL PROCESS ENGINEERING
Involves the analysis and design of processes of water treatment, waste treatment, and environmental remediation, and includes a solid grounding in the chemical, biological, and physical principles underlying treatment and remediation technologies.

WATER RESOURCES ENGINEERING
Combines a solid grounding in environmental fluid mechanics and hydrology with electives in modeling, water development planning, policy, and contaminant fate and transport.

ENVIRONMENTAL MANAGEMENT AND ECONOMICS
Focuses on using models of physical and economic systems to analyze and improve the design of public policies and environmental control systems.

DATA SCIENCE AND ANALYTICS FOR ENVIRONMENTAL HEALTH AND ENGINEERING
Emphasizes innovative computational, statistical, and "big data" tools with applications to environmental problems in air pollution, energy systems, hydrology, and climate change.

Program Requirements

The following general requirements apply to all M.S.E. students:

- a minimum of 30 graduate credits including no more than 1 credit of seminar, 1 credit of intersession course work or 1.5 credits from CLE (with advisor approval), and 6 credits of independent research counting toward the 30 credits.
- at least 50% of the required 30 credits must come from courses within the department.
- students are permitted to apply up to two classes with a grade of "C" toward their degree.
- 5-6 required courses and 4-5 recommended elective courses depending on concentration (Note: In order to substitute an alternate course for a recommended elective, students must receive written approval from their advisor).
- prerequisites (required) for the M.S.E. program include mathematics: differential equations and computing skills.
- up to two courses from AAP or EP may be taken and counted to receive a master's degree as long as there is sufficient rigor and prior approval as deemed by the advisor. Students must have written consent from advisor (an email will suffice) prior to signing up for the course.

The M.S.E. program is typically a two semester program based on course work alone. However, M.S.E. students have the option to complete an independent research project, submitted as a formal essay or group project report. An M.S.E. degree with significant research components will usually require three to four semesters for completion and is generally intended for those students planning to work in engineering practice. Each individual's program of study is planned by the student in consultation with department faculty and must be approved by the faculty advisor. M.S.E. students select from the concentrations below.

Tracks for the M.S.E. Degree

Contaminant Fate and Transport

This concentration emphasizes understanding of physical, chemical, and biological phenomena that affect the movement and transformation of pollutants in the environment.

Core courses:

Code	Title	Credits
EN.575.645	Environmental Microbiology	3
EN.570.615	Current Trends in Environmental Microbiology	3
EN.570.641	Environmental Inorganic Chemistry	3
EN.570.643	Aquatic and Biofluid Chemistry	3
EN.570.652	Experimental Methods in Environmental Engineering and Chemistry	4

One course in applied mathematics, numerical analysis, or engineering mathematics, such as:

Code	Title	Credits
EN.570.695	Environmental Health and Engineering Systems Design	3
EN.570.697	Risk and Decision Analysis	3
EN.560.601	Applied Math for Engineers	3
Recommended electives include:		
EN.570.619	Methods in Microbial Community Analysis	3
EN.570.647	Hydrologic Transport in the Environment	3
EN.570.651	Environmental Transport and Dispersion	3
EN.570.657	Air Pollution	3
AS.270.641	Present and Future Climate	

Environmental Process Engineering

This concentration involves the analysis and design of processes of water treatment, waste treatment, and environmental remediation, and includes a solid grounding in the chemical, biological, and physical principles underlying treatment and remediation technologies.

Code	Title	Credits
Core courses:		
EN.570.643	Aquatic and Biofluid Chemistry	3
EN.570.644	Physical and Chemical Processes	3
EN.570.648	Physical and Chemical Processes II	3
EN.570.652	Experimental Methods in Environmental Engineering and Chemistry	4

EN.575.645	Environmental Microbiology	3
EN.575.706	Biological Processes for Water & Wastewater Treatment	3
One course in applied mathematics, numerical analysis or engineering mathematics, such as:		
EN.570.695	Environmental Health and Engineering Systems Design	3
EN.570.697	Risk and Decision Analysis	3
EN.570.616	Data Analytics in Environmental Health and Engineering	3
Additional requirements: an introductory fluid mechanics course If this prereq is lacking, it can be taken as part of the course of study, but the credits will not be counted toward the 30-credit requirement		
Recommended electives include:		
EN.570.691	Hazardous Waste Engineering and Management	3
At least one course in Geomorphology, Hydrology, or Ecology		
At least one course in Systems Analysis and Economics		

Water Resources Engineering

This concentration combines a solid grounding in environmental fluid mechanics and hydrology with electives in modeling, water development planning, policy, and contaminant fate and transport.

Code	Title	Credits
Core courses:		
EN.570.653	Hydrology	3
EN.570.651	Environmental Transport and Dispersion	3
EN.570.412	Landscape Hydrology and Watershed Analysis	3
One course in applied mathematics, numerical analysis, or engineering mathematics, such as:		
EN.570.616	Data Analytics in Environmental Health and Engineering	3
EN.570.695	Environmental Health and Engineering Systems Design	3
EN.570.697	Risk and Decision Analysis	3
Additional requirements: an introductory fluid mechanics course. If this prerequisite is lacking, it can be taken as part of the course of study, but the credits will not be counted toward the 30-credit requirement.		
Recommended electives include:		
At least one course in Systems Analysis and Economics		
EN.570.631	Collaborative Modeling for Resolving Water Resources Disputes	3
EN.570.643	Aquatic and Biofluid Chemistry	3
EN.570.644	Physical and Chemical Processes	3
EN.570.654	Geostatistics: Understanding Spatial Data	3

Environmental Management and Economics

This concentration focuses on using models of physical and economic systems to analyze and improve the design of public policies and environmental control systems.

Code	Title	Credits
Core courses:		
EN.570.616	Data Analytics in Environmental Health and Engineering	3
EN.570.695	Environmental Health and Engineering Systems Design	3
EN.570.697	Risk and Decision Analysis	3
Recommended electives include:		
• At least one course in physical, chemical, or biological processes		
EN.570.618	Multiobjective Programming and Planning	3
EN.570.631	Collaborative Modeling for Resolving Water Resources Disputes	3

Data science and analytics for ehe

This concentration emphasizes innovative computational, statistical, and "big data" tools with applications to environmental problems in air pollution, energy systems, hydrology, and climate change.

Code	Title	Credits
Data Science Foundations (2 courses)		
The following two courses are recommended:		
EN.570.616	Data Analytics in Environmental Health and Engineering	3
EN.570.654	Geostatistics: Understanding Spatial Data	3
Students can also take the following courses to fulfill this requirement:		
EN.553.620	Introduction to Probability	4
EN.553.626	Introduction to Stochastic Processes	4
EN.553.630	Introduction to Statistics	4
AS.270.654	Environmental Data Analysis	
AS.180.334	Econometrics	3
Environmental Foundations (3 courses)		
Students interested in air pollution and climate should consider the following courses:		
EN.570.657	Air Pollution	3
PH.182.615	Airborne Particles	4
PH.180.607	Climate Change and Public Health	3
AS.270.679	Atmospheric Science	
AS.270.641	Present and Future Climate	
AS.270.618	Remote Sensing of the Environment	
Students interested in hydrology and water resources should consider the following courses:		
EN.570.351	Introduction to Fluid Mechanics	3
EN.570.653	Hydrology	3
EN.570.647	Hydrologic Transport in the Environment	3
EN.570.651	Environmental Transport and Dispersion	3
EN.570.643	Aquatic and Biofluid Chemistry	3
AS.270.618	Remote Sensing of the Environment	
Students interested in energy systems should consider the following courses:		
EN.570.607	Energy Policy and Planning Models	3
EN.570.697	Risk and Decision Analysis	3
Students interested in health applications should consider the following courses:		
PH.185.621	METHODS IN THE EXPOSURE SCIENCES	3
PH.182.613	Exposure Assessment Techniques for Health Risk Management	3
Advanced Data Science (2 courses)		

Students should take two additional courses in statistics, applied match, or computing. Graduate-level courses in the following department will fulfill this requirement: EHE (only Geostatistics fulfills this requirement if not used to fulfill requirements in the Data Science Foundations category), Applied Math and Statistics (e.g., Data Mining, Bayesian Statistics, Seminar in Data Analysis, and other courses), Computer Science (e.g., Parallel Programming, Causal Inference, and other courses), Biostatistics, and Earth & Planetary Sciences (only Inversion Modeling & Data Assimilation or Geoscience Modeling fulfills this requirement).

Data Science Project (3 credits)

This requirement is waived if students are conducting master's thesis research for credit.