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.

### 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 the use of models of physical and economic systems to analyze and improve the design and operations of public policies, environmental control systems, and infrastructure for energy, transportation, water, and other critical services.

**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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EN.570.645</td>
<td>Environmental Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.615</td>
<td>Current Trends in Environmental Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.641</td>
<td>Environmental Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.643</td>
<td>Aquatic and Biofluid Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.652</td>
<td>Experimental Methods in Environmental Engineering and Chemistry</td>
<td>4</td>
</tr>
</tbody>
</table>

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

<table>
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</thead>
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<tr>
<td>EN.570.695</td>
<td>Environmental Health and Engineering Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.697</td>
<td>Risk and Decision Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EN.560.601</td>
<td>Applied Math for Engineers</td>
<td>3</td>
</tr>
</tbody>
</table>

**Recommended electives include:**

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<tbody>
<tr>
<td>EN.570.619</td>
<td>Methods in Microbial Community Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.647</td>
<td>Hydrologic Transport in the Environment</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.651</td>
<td>Environmental Transport and Dispersion</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.657</td>
<td>Air Pollution</td>
<td>3</td>
</tr>
<tr>
<td>AS.270.641</td>
<td>Present and Future Climate</td>
<td>3</td>
</tr>
</tbody>
</table>

### 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.

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<tr>
<td>EN.570.643</td>
<td>Aquatic and Biofluid Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.644</td>
<td>Physical and Chemical Processes</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.648</td>
<td>Physical and Chemical Processes II</td>
<td>3</td>
</tr>
<tr>
<td>EN.570.652</td>
<td>Experimental Methods in Environmental Engineering and Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>EN.575.645</td>
<td>Environmental Microbiology</td>
<td>3</td>
</tr>
</tbody>
</table>
Environmental control systems.

This concentration focuses on using models of physical and economic mechanics and hydrology with electives in modeling, water development planning, policy, and contaminant fate and transport.

### Core courses:

- EN.570.653 Hydrology
- EN.570.412 Landscape Hydrology and Watershed Analysis
- EN.570.651 Environmental Transport and Dispersion

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

- EN.570.695 Environmental Health and Engineering Systems Design
- EN.570.616 Data Analytics in Environmental Health and Engineering
- EN.570.697 Risk and Decision Analysis
- EN.570.654 Geostatistics: Understanding Spatial Data

**Recommended electives include:**

- EN.570.691 Hazardous Waste Engineering and Management

At least one course in Geomorphology, Hydrology, or Ecology, such as:

- EN.570.619 Methods in Microbial Community Analysis
- EN.570.651 Environmental Transport and Dispersion
- EN.570.647 Hydrologic Transport in the Environment

At least one course in Systems Analysis and Economics, such as:

- AS.270.618 Remote Sensing of the Environment
- AS.270.641 Present and Future Climate

### 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.

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<tr>
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<td>Environmental Transport and Dispersion</td>
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One course in applied mathematics, numerical analysis, or engineering mathematics, such as:

- EN.570.695 Environmental Health and Engineering Systems Design
- EN.570.697 Risk and Decision Analysis
- EN.530.766 Numerical Methods
- EN.570.616 Data Analytics in Environmental Health and Engineering

**Recommended electives include:**

- EN.570.615 Current Trends in Environmental Microbiology
- EN.570.631 Collaborative Modeling for Resolving Water Resources Disputes
- EN.570.643 Aquatic and Biofluid Chemistry
- EN.570.644 Physical and Chemical Processes
- EN.570.642 Environmental Organic Chemistry
- EN.570.641 Environmental Inorganic Chemistry
- EN.570.652 Experimental Methods in Environmental Engineering and Chemistry
- EN.570.654 Geostatistics: Understanding Spatial Data

### 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.

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<tr>
<td>EN.570.697</td>
<td>Risk and Decision Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Recommended electives include:**

At least one course in physical, chemical, or biological processes

- EN.570.618
- EN.570.631 Collaborative Modeling for Resolving Water Resources Disputes

### 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.

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<td>Geostatistics: Understanding Spatial Data</td>
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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 3
- 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

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 3

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.