ENVIRONMENTAL AND SUSTAINABILITY ENGINEERING (M.S.)

The Master of Science in Environmental and Sustainability Engineering aims to advance environmental engineering and sustainability to enhance human well-being through the development, application, and dissemination of relevant knowledge. The curriculum is arranged into four themes:

1. Systems & Resources – topics within this area vary in scale and include: modeling of groundwater, surface water, and air systems; engineered systems such as drinking water distribution systems; and interactions between the environment and urban systems (e.g. stormwater management).
2. Treatment & Sensing Technologies – topics within this area focus on the mitigation and quantification of pollutants loads to the environment, including humans, within all media (air, water, soils).
3. Bio-chemical-physical Processes – topics within this area focus on fundamental process that control the fate and transport of pollutants, including remediation techniques.
4. Environmental Exposure and Risk – topics within this area focus on identifying, quantifying and reducing risk.

Admission Requirements

Admission to this program is contingent upon admission to the Graduate School (http://bulletins.wayne.edu/graduate/general-information/admission/).

The M.S. in Environmental and Sustainability Engineering will admit students with bachelor’s degrees or the equivalent in engineering and other qualified science programs if there is a demonstrated aptitude for quantitative analysis. The degree program is suitable for new or recent graduates, as well as experienced professionals. Students will be required to have significant mathematics-based science capabilities. Students should have an overall grade point average (g.p.a.) of 3.2 for regular admission. Qualified or probationary admission may be granted with a lower g.p.a. As noted above, field/professional experience will be viewed positively in the application review process.

The M.S. in Environmental and Sustainability Engineering requires a minimum of thirty credits under one of two degree plans approved by the College of Engineering:

**Plan A:** consists of a minimum of twenty-four credit hours of course-work in combination with a minimum of six credits of thesis.

**Plan C:** consists of a minimum of thirty credits of course-work.

MS students may take a maximum of three credits of CE 7990 and a maximum of three credits of CE 7996. Registration in CE 7990 and/or CE 7996 must be approved by a faculty advisor and the graduate program director.

The program is designed to provide graduates a core of systems, treatment, process, and exposure/risk skills in research and applied situations.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 7990</td>
<td>Advanced Transport Phenomena</td>
<td></td>
</tr>
<tr>
<td>ME 5300</td>
<td>Intermediate Fluid Mechanics</td>
<td></td>
</tr>
<tr>
<td>ME 7300</td>
<td>Advanced Fluid Mechanics</td>
<td></td>
</tr>
<tr>
<td>ME 7310</td>
<td>Computational Fluid Mechanics and Heat Transfer</td>
<td></td>
</tr>
<tr>
<td>IE 6210</td>
<td>Applied Engineering Statistics</td>
<td></td>
</tr>
<tr>
<td>IE 6270</td>
<td>Engineering Experimental Design</td>
<td></td>
</tr>
<tr>
<td>BIO 5100</td>
<td>Aquatic Ecology</td>
<td></td>
</tr>
<tr>
<td>MAT 5070</td>
<td>Elementary Analysis</td>
<td></td>
</tr>
<tr>
<td>MAT 5770</td>
<td>Mathematical Models in Operations Research</td>
<td></td>
</tr>
<tr>
<td>MAT 5870</td>
<td>Methods of Optimization</td>
<td></td>
</tr>
</tbody>
</table>

**Water Resources Foundational Area:**

- CE 6130 Open Channel Hydraulics
- CE 6150 Hydrologic Analysis and Design
- CE 6190 Groundwater

**Chemistry Foundational Area:**

- CE 5220 Environmental Chemistry
- CE 6160 Principles of Atmospheric Chemistry and Applications
- CE 7160 Advanced Principles of Atmospheric Chemistry and Applications

**Biology Foundational Area:**

- CE 7280 Applied Environmental Microbiology

**Statistics Foundational Area:**

- CE 7070 Risk and Reliability in Civil Engineering
- CE 7080 Civil Engineering Research Methods

**Other Civil & Environmental Engineering course options include:**

- CE 5230 Water Supply and Wastewater Engineering
- CE 5410 Energy, Emissions, Environment (E3) Design
- CE 5510 Geotechnical Engineering I
- CE 5520 Geotechnical Engineering II
- CE 5595 Special Topics in Civil Engineering I
- CE 6170 River Assessment and Restoration I
- CE 6270 Sustainability Assessment and Management
- CE 6580 Geoenvironmental Engineering I
- CE 6910 Pharmaceutical Waste: Environmental Impact and Management
- CE 7170 Advanced River Assessment and Restoration I
- CE 7190 Groundwater Modeling
- CE 7220 Industrial Waste Treatment
- CE 7240 Advanced Air Pollution Engineering
- CE 7311 Sustainability of Urban Environmental Systems
- CE 7300 Environmental Properties of Soils
- CE 7580 Environmental Remediation
- CE 7990 Directed Study
- CE 7995 Special Topics in Civil Engineering II
- CE 7996 Research
- CE 8999 Master’s Thesis Research and Direction

Students may also take up to 9 credits from electives (as approved by advisor), such as:

- CHE 7200 Advanced Transport Phenomena
- ME 5300 Intermediate Fluid Mechanics
- ME 7300 Advanced Fluid Mechanics
- ME 7310 Computational Fluid Mechanics and Heat Transfer
- IE 6210 Applied Engineering Statistics
- IE 6270 Engineering Experimental Design
- BIO 5100 Aquatic Ecology
- MAT 5070 Elementary Analysis
- MAT 5770 Mathematical Models in Operations Research
- MAT 5870 Methods of Optimization

The graduation requirement is completion of the M.S. courses with an overall GPA of 3.00 or higher. All core classes in the program must be completed with a 3.00 score or better. And all course work must be completed in accordance with the regulations of the Graduate School (http://bulletins.wayne.edu/graduate/general-information/academic-
and the College of Engineering (http://bulletins.wayne.edu/graduate/college-engineering/academic-regulations/).