Engineering Faculty
The following faculty are associated with the environmental engineering program. Professors Aitken*, Bartram, Characklis*, Coronell*, Cory*, Flynn*, Gray*, Kolsky*, MacDonald Gibson*, Miller*, Serre*, Surratt, Weinberg, West*, and Vizuete*

* faculty who hold engineering degrees or equivalent

Learning Objectives
Upon satisfactory completion of an MSEE degree in ESE, graduates will be able to:

1) Identify environmental engineering problems, needs, and objectives;
2) Evaluate problems quantitatively using measurements and models of environmental media (e.g., air, soil, and water);
3) Develop and design appropriate controls and facilities to solve environmental engineering problems;
4) Evaluate the success of environmental engineering designs and assess the uncertainty involved; and
5) Demonstrate written and oral communication skills related to environmental engineering.

Success in achieving these learning objectives is measured by the successful completion of all degree requirements, including formal course work and a comprehensive oral examination, at which time the master’s technical report is presented and defended. Students may also prepare other reports; present their work at seminars and at national or international meetings; and publish in the peer-reviewed literature.

Degree Requirements
Students may be admitted to the MSEE degree program if they have completed an undergraduate curriculum in engineering from an ABET-accredited program or from a foreign institution with an equivalent program. Once admitted, the following requirements must be met:

(1) Students and their advisors should develop a written coursework plan during the first semester of study.

(2) Students must complete at least 12 hours of engineering coursework offered in the Department of Environmental Sciences and Engineering (see attached list) or graduate-level engineering courses from another institution. Courses taken at another institution must be approved by the student's advisor.

(3) Students who have not already had an undergraduate or graduate course in probability and statistics and an undergraduate or graduate course in the biological sciences must take an appropriate course on each topic while in the MSEE program. The acceptability of courses to fulfill these requirements should be decided after consultation with the student's advisor.
(4) MSEE student committees must include at least two members from among the environmental engineering faculty. At least one committee member must hold a degree in engineering as noted in the list of engineering faculty below.

(5) MSEE students must meet all other requirements of the Department, Gillings School of Global Public Health and the Graduate School. These requirements include:

- ENVR 400, ESE Seminar (1 credit) (Departmental requirement)
- A course in epidemiology (3 credits) (School requirement)
- A course in the principles of public health (3 credits) (School requirement)
- A minimum of 24 credits in formal coursework (which excludes credits for research, for ENVR 400, and for ENVR 992) (Departmental requirement)
- A minimum of three credits for ENVR 992, Master's Technical Report (Graduate School requirement)
- A minimum of 30 credits (Graduate School requirement)
- A minimum of 24 credits in residence; i.e., credit obtained through registration at UNC-CH (Graduate School requirement)

(6) In accordance with Graduate School rules, up to six credits toward the MSEE degree requirements can be transferred from graduate courses taken at a previously-attended institution if the course(s) were not counted toward requirements for the undergraduate degree.

August Orientation
All students will take part in a non-credit orientation to the MSEE program, which will include an introduction to the structure and process of preparing the 3 engineering briefs, an introduction to the facilities and services of the Gillings School of Global Public Health and the University of North Carolina, and reinforcement of written and verbal communications skills in the context of engineering practice.

Students are required to prepare a portfolio of 3 briefs (each of 12-20 pages length, double-spaced, exclusive of references) which:

- Identify an environmental engineering problem
- Identify a suitable engineering solution
- Describe the implementation of an engineering solution

Problem Identification Brief (1.0 credit-hour): This written brief defines a relevant environmental engineering problem with sufficient precision that engineering solutions may be developed to address it. The design brief may require field work, data collection and analysis. (submitted in November)

Solution Identification Brief (1.0 credit-hour): Written description of an engineering solution to the problem identified in the Problem Identification Brief. This brief will describe a range of technical options and a recommendation as to the preferred solution, with sufficient precision that implementation plans could subsequently be developed. The proposal may include a range of measures (e.g. institutional, legal, financial, and communications activities) complementing technical ones. (submitted in February)
Implementation Brief (1.0 credit-hour): This brief constitutes a written implementation plan for the environmental engineering proposal or intervention, showing how the solution can be most effectively implemented. This will require estimation of resource requirements, scheduling, costing, and resolution of technical issues of implementation. (submitted in May)

MSEE Technical Report (3.0 credit-hours): A portfolio that combines the three individual project elements (problem, solution, and implementation briefs), together with an overarching Introduction and Conclusions will be submitted to a faculty committee. The engineering significance of the project must be made apparent. In addition to the complete written portfolio, the project will be presented orally as part of the final comprehensive examination.

At the end of the program, each student will possess a portfolio of independent work illustrating the three essential tasks of engineering planning and analysis.

### Engineering Courses in ESE

<table>
<thead>
<tr>
<th>ENVR Course</th>
<th>Title</th>
<th>Faculty</th>
<th>Fall</th>
<th>Spring</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>Air</th>
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<td>416</td>
<td>Aerosol Physics Chemistry</td>
<td>Surratt</td>
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<td>433</td>
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<td>451</td>
<td>Chemical Rxn Engineering</td>
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<td>Fundamentals of Environmental Physics: I</td>
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**Coverage of Objectives**
- 0: Does not address
- +: Minor
- ++: Moderate
- +++: Substantive

**Learning Objectives**
1. Identify environmental engineering problems, needs, and objectives
2. Evaluate problems quantitatively using measurements and models of contaminant transport or reactions in environmental media (e.g., air, soil, and water)
3. Develop and design appropriate controls and facilities to solve environmental engineering problems
4. Evaluate the success of environmental engineering designs and assess the uncertainty
5. Demonstrate written and oral communication skills related to environmental engineering
Courses at Other Institutions
North Carolina State University:
CE 576 Air Pollution Control (spring)
CE 579 Air Quality (fall)
CE 774 Environmental Bioprocess Technology (fall)

Duke University:
CD 124L Biological Processes in Environmental Engineering (spring)

Note: If courses taught at another institution are proposed to help satisfy the requirement for engineering coursework, they must be approved for this purpose by the student’s advisor.

Non-Engineering Courses of Interest to Environmental Engineers
The courses listed below may be of interest to students in the MSEE program, but do not count toward the 12 hours of engineering coursework required for the MSEE degree.

Fall
ENVR 411 Lab Techniques and Field Measurements Weinberg
ENVR 413 Limnology Whalen
ENVR 419 Chemical Equilibria in Natural Waters Cory
ENVR 430 Health Effects of Environmental Agents Ball
ENVR 585 American Environmental Policy Andrews
ENVR 724 Current Topics in Environmental Analytical Chem b Weinberg
ENVR 727 Chemistry of Humic Substances Cory
ENVR 732 Health Effects of Outdoor and Indoor Air Pollution Hazucha
ENVR 890 Exposure Analysis Flynn
ENVR 890 Methods of Environmental Decision Analysis MacDonald Gibson

Spring
ENVR 412 Ecological Microbiology Stewart
ENVR 421 Environmental Health Microbiology Sobsey
ENVR 423 Industrial Medicine and Toxicology Stopford
ENVR 442 Biochemical Toxicology Rusyn
ENVR 470 Environmental Risk Assessment MacDonald Gibson
ENVR 471 Water, Sanitation, Hygiene and Global Health Bartram, Sobsey
ENVR 575 Global Climate Change: Science, Impacts, Solutions West
ENVR 630 Systems Biology in Environmental Health Fry
ENVR 685 Water Policy in Less Developed Countries Whittington
ENVR 725 Environmental Organic Chemistry Cory
ENVR 726 Instrumental Methods for the Chemical Analysis of Environmental Samples Weinberg
ENVR 770 Biological Monitoring Nylander French
ENVR 785 Environmental and Resource Economics Whittington
ENVR 890 Setting Environmental Priorities a Characklis
a even numbered years
b odd numbered years

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