Department of Environmental Sciences and Engineering
University of North Carolina at Chapel Hill
Master of Science in Environmental Engineering (MSEE)
Degree Requirements

Engineering Faculty

The following faculty are associated with the environmental engineering program:
Professors Aitken*, Bartram, Characklis*, Coronell*, Cory*, Flynn*, Gray*, Kolsky*, MacDonald Gibson*, 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 above.

(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 three engineering briefs required for the Master's Technical Report, an introduction to the facilities and services of the Gillings School of Global Public Health and the University of North Carolina at Chapel Hill, and reinforcement of written and verbal communications skills in the context of engineering practice.

Master's Technical Report Requirement

Students are required to prepare a portfolio of three 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 detail that engineering solutions may be developed to address it. The design brief may require field work, data collection and analysis, but can also be completed with existing information. (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 detail 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

			Semester		Learning Objective					Focus Area	
ENVR Course	Title	Faculty	Fall	Spring	1	2	3	4	5	Water	Air
416	Aerosol Physics Chemistry	Surratt	A		++	+++	+	+	++		X
433	Health Hazards of Industrial Operations	Flynn	A		++	+++	0	0	0		X
451	Chemical Rxn Engineering	Vizuete	A		+++	+++	+++	++	+++	X	X
468	Temporal GIS	Serre	A		+	++	0	+++	+++	X	X
671	Fundamentals of Environmental Physics: I	Miller, Gray	A		+++	+++	+	++	+++	X	X
675	Air Pollution Chemistry and Physics	West	A		++	+++	+	+	+		X
755	Analysis of Water Resource Systems	Characklis	A		+++	+++	+	++	+++	X	
890	Science and Technology of Membranes	Coronell	A		+	+++	+++	++	++	X	
666	Numerical Methods	Miller	E		+	+++	0	0	+++	X	
453	Groundwater Hydrology	Miller	O		+++	+++	+++	+++	+++	X	
461	Environmental Modeling	Gray		A	++	+++	0	++	+++	X	X
672	Fundamentals of Environmental Physics: II	Miller, Gray		A	+++	+++	+	++	+++	X	
756	Physical Chemical Processes for Water Treatment	Coronell		A	++	++	+++	+++	0	X	
759	Multiphase Transport Phenomena	Gray,Miller		E						X	
765	Space Time Exposure Mapping	Serre		E	+	++	0	+++	++	X	X
760	Stochastic Environmental Modeling	Miller		O						X	X
773	Modeling Atm Chemistry	Vizuete		O	+++	++	0	+++	++		X
850	Surface Water Quality	Characklis		E	+++	+++	+	+++	++	X	
890-002	Water Supply Plan and Design	Kolsky		A	+++	+	+++	++	++	X	

A=All
E=Even numbered years only
O=Odd numbered years only

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 Chemistry	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	Characklis

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