

# ENGINEERING, MASTER OF SCIENCE (M.S.) WITH A CONCENTRATION IN ENVIRONMENTAL AND SUSTAINABLE ENGINEERING

## Program mission

The mission of the M.S. in Engineering degree is to provide graduate students with learning opportunities for acquiring a broad foundation of engineering knowledge including business and manufacturing aspects; an in-depth research experience at the frontiers of engineering; and skills for lifelong learning and professional development. Graduates of this program will pursue careers in business/industry and government, or will pursue doctoral degrees.

1. **Advanced research skills:** To produce graduates who possess the necessary advanced analytical, technical and research skills in engineering and the sciences – responds directly to the higher goal of fulfilling the needs of industry, academe and research laboratories for effective, productive engineers, professors and researchers
2. **Communication:** To produce graduates who possess a facility with both written and oral communications – emanates from the requirement that engineers, researchers and professors must be able to interact and share ideas with others in the work environment, and at a higher level, be capable of creative self-expression, conveying knowledge and leadership
3. **Advanced problem-solving:** To produce graduates who demonstrate creativity and innovation in solving technological problems – stems from the realization that new knowledge and new solutions to existing problems are necessary to meet the needs of our changing society and to advance the quality of human life

## Student learning outcomes

1. **Apply advanced knowledge of mathematics, science or engineering:** Graduates will demonstrate an ability to apply advanced knowledge of mathematics, science or engineering.
2. **Communicate effectively:** Graduates will demonstrate an ability to communicate effectively.
3. **Identify, formulate and solve engineering problems:** Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
4. **Analyze and synthesize knowledge within the field of environmental and sustainable engineering to help develop practical solutions to address societal challenges.**

## VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the

graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the **Graduate School website** and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

**Visit the academic regulations section for additional information on academic regulations for graduate students.**

## Degree candidacy requirements

A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master's or doctoral status according to the degree candidacy requirements of the student's graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student's faculty regarding the student's academic achievements and the student's readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

**Visit the academic regulations section for additional information on degree candidacy requirements.**

## Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

**Visit the academic regulations section for additional information on graduation requirements.**

## Other information

Student handbook (<http://www.egr.vcu.edu/current-students/graduate-student-services/resources-forms/>) is available on the College of Engineering website.

Apply online today. (<https://www.vcu.edu/admissions/apply/graduate/>)

## Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
M.S.	Fall (preferred)	Jun 1 (Jan 15 for financial assistance)	International students require TOEFL (A minimum score of 100 in the TOEFL exam is required to be considered for financial assistance.)
	Spring	Nov 15	

**Note:** Students may begin a course of study in either the fall or spring semester for the engineering programs, although a start in the fall semester is preferred.

In addition to the general admission requirements of the VCU Graduate School (<http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/>) and the College of Engineering, applicants to the environmental and sustainable engineering concentration must have a B.S. degree in engineering, chemistry or a closely related discipline.

## Degree requirements

In addition to the VCU Graduate School graduation requirements (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students must meet the following requirements.

### Thesis option

Students seeking the M.S. degree are required to take a minimum of 30 credit hours of approved graduate courses (including research). Each student must complete 12 credit hours in concentration course work, 12 credit hours in concentration electives and six credit hours in thesis research. The student's adviser must review and approve all course work and thesis research credit hours. The total of all credit hours must be at least 30. No elective courses may be used for both M.S. and Ph.D. degrees. At least half of the credit hours required in the student's program must be those designated as exclusively for graduate students, that is, those at the 600 level or above.

Each student must conduct an original investigation under the supervision of the permanent adviser and prepare a thesis reporting the results of this research and analyzing its significance in relation to existing scientific knowledge. This study is reported in a thesis prepared in acceptable form and style. Upon approval of the thesis by the adviser, the student submits a copy to each member of the advisory committee. The student's advisory committee members examine the thesis and decide upon its acceptability. Each committee member reports to the student's adviser when the thesis is acceptable for defense. The thesis is approved for defense only if accepted unanimously. Upon approval of the thesis, the student appears for a final oral examination administered by the student's advisory committee. This examination of an M.S. candidate includes the subject matter of course work as well as the thesis.

### Non-thesis option

Students seeking the non-thesis M.S. degree are required to take a minimum of 30 credit hours of approved graduate courses. Each student

must complete 12 credit hours in concentration course work and 18 credit hours in concentration electives.

Each non-thesis student must have a plan of study by the end of the first semester or prior to completing nine credit hours. This plan of study (and all revisions) must be approved by the student's adviser and the assistant dean for graduate affairs of the College of Engineering. The student's adviser must review/approve all course work in advance of enrollment. At least half the credit hours required in the student's program must be designated as 600 level or above.

## Curriculum requirements

There are three components of each M.S. in Engineering option:

- 1. Concentration (-specific) component:** This component allows the student to pursue a series of courses that focus on a specific field of engineering and serve as the student's primary engineering discipline.
- 2. Concentration electives component:** This component allows the student to take courses in either engineering or science with approval of the student's adviser (e.g. CLSE, ENGR, ENVS courses at 500 level or higher)
- 3. Directed research component:** This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

The option can be tailored to meet the individual student's academic goals and research interests. Students seeking to take course work and conduct their research in the environmental and sustainable engineering concentration should contact the graduate program coordinator or department chair of chemical and life science engineering for detailed information about that concentration.

### Thesis option

Course	Title	Hours
<b>Concentration component</b>		
CLSE 545	Water Essentials	3
CLSE 580	Sustainable Chemical Engineering	3
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
<b>Concentration electives</b>		
Engineering or science course work (including 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE, PHYS, MATH, OPER, STAT, CHEM, ENVS, LFSC) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
<b>Directed research component</b>		
This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.		6
CLSE 697	Directed Research in Chemical and Life Science Engineering	
<b>Total Hours</b>		<b>30</b>

**The minimum number of graduate credit hours required for this degree is 30.**

**Non-thesis option**

Course	Title	Hours
<b>Concentration component</b>		
CLSE 545	Water Essentials	3
CLSE 580	Sustainable Chemical Engineering	3
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
<b>Concentration electives</b>		
Engineering or science course work (including 500-level or higher courses in CLSE, EGRE, ENGR, EGRB, EGMN, CMSC, CHEM, ENVS, LFSC, PHYS, MATH, OPER, STAT) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		18
<b>Total Hours</b>		<b>30</b>

**The minimum number of graduate credit hours required for this degree is 30.**

Students who complete the requirements for this degree will receive a Master of Science in Engineering.

**Contact**

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**Program website:** [egr.vcu.edu/academics/grad-degrees/environmental-and-sustainable-engineering-masters/](https://egr.vcu.edu/academics/grad-degrees/environmental-and-sustainable-engineering-masters/) (<https://egr.vcu.edu/academics/grad-degrees/environmental-and-sustainable-engineering-masters/>)