

# **Civil and Environmental Engineering**

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## **MS and PhD Degree Requirements by Program of Study**

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## A. INTRODUCTION

The Department of Civil and Environmental Engineering (CEE) at Northwestern University is a premier research and academic department ranked among the top CEE departments in the nation. With approximately 30 experienced faculty members, CEE provides graduate students with an exceptional range of opportunities to advance their knowledge and careers in a scholarly community small enough to assure individual attention and effective mentoring.

CEE prepares students to become the next generation of leaders in research, academic, corporate, and public service settings. It offers the Master of Science (MS) and Doctor of Philosophy (PhD) degrees in civil and environmental engineering through Northwestern University's Graduate School. Students work with their advisor to construct study plans suited to their unique interests. These include extensive options for courses outside civil and environmental engineering that address a wide variety of social, economic, and physical challenges in constructing and managing the industrial and public works infrastructure.

The department is divided into five Programs of Study: Environmental Engineering and Science, Geotechnics and Environmental Geotechnics, Mechanics of Materials and Solids, Structural Engineering and Materials, and Transportation Systems Analysis and Planning. In the following sections, MS and PhD degree requirements will be outlined for each Program of Study.

## B. ADMISSION REQUIREMENTS

CEE graduate students come from throughout the world with degrees in a variety of fields including engineering, mathematics, the physical sciences, management, economics, and other social sciences. Admissions decisions are based on the overall academic picture presented through GRE exams and transcripts, as well as the statement of purpose and letters of recommendation.

## C. COURSE WORK REQUIREMENTS

*Environmental Engineering and Science (EES):* All students must complete a minimum of 9 courses for a letter grade to satisfy The Graduate School's minimum course work requirement. More courses may be required by your advisor and/or Program of Study. For instance, MS students in EES must complete a minimum of 12 grad-level (units) in this manner: 9 units (courses) for a letter grade, and no more than 2 research units can be used for the 12 units. PhD students in EES must complete 9 courses for a letter grade and any additional courses directed by your advisor.

All EES students are required to complete 6 core courses: CIV\_ENV 361-1, 365, 367, 440, 444, 448, and also 516-1,2,3 – a required no-credit, no-tuition Seminar in Environmental Engineering and Science.

In addition, EES students must complete (with faculty approval) a 3-course thematic specialization in some aspect of environmental engineering and science with faculty approval. Examples:

Environmental Chemistry: CIV\_ENV 447, 468, MAT\_SCI 360  
Environmental Microbiology: CIV\_ENV 441, 442, 443

*Geotechnics (GEO):* All students must complete a minimum of 9 courses for a letter grade to satisfy The Graduate School's minimum course work requirement. More courses may be required by your advisor and/or Program of Study. For instance, MS students in GEO must complete a minimum of 10 courses plus research and thesis. PhD students in GEO must complete 18 courses post-BS or 12 courses post-external MS, excluding thesis. All students must complete core courses CIV\_ENV 450-1,2,3, 451, and 358, as well as 3 of the following: CIV\_ENV 355, 453, 454, and 458. Students must also build one or two minor areas of study through courses in a series of 3 or more and attend CIV\_ENV 515-1,2 – a required no-credit, no-tuition Seminar in Geotechnics.

*Mechanics of Materials and Solids (MMS):* All students must complete a minimum of 9 courses for a letter grade to satisfy The Graduate School's minimum course work requirement. More courses may be required by your advisor and/or Program of Study. For instance, MS students in MMS must complete a minimum of 10 courses plus research and thesis post-BS. PhD students in MMS must complete 18 courses post-BS or 12 courses post-external MS, excluding thesis. All students are required to take the following core courses: CIV\_ENV 318, 327, 411, 413, 414-1,2, 415, 417-1,2, 419, 426-1,2. Students must also take electives from: Mechanics of Materials and Solids, Structural Engineering and Materials, Engineering Sciences and Applied Mathematics, Mechanical Engineering, Material Science and Engineering.

*Structural Engineering and Materials (STR):* All students must complete a minimum of 9 courses for a letter grade to satisfy The Graduate School's minimum course work requirement. More courses may be required by your advisor and/or Program of Study. For instance, MS students in STR must take a minimum of 11 courses post-MS plus a thesis or project (2 units). PhD students in STR typically complete at least 6 additional courses. The following courses are required for all students: CIV\_ENV 306, 307, 320, 321, 422, 423, 424 and attend 512-1,2,3 – a required no-credit, no-tuition Seminar in Structural Engineering and Materials. Students must also take electives from: Mechanics of Materials and Solids, Structural Engineering and Materials, Engineering Sciences and Applied Mathematics, Mechanical Engineering, Material Science and Engineering.

*Transportation Systems Analysis and Planning:* All students must complete a minimum of 9 courses for a letter grade to satisfy The Graduate School's minimum course work requirement. More courses may be required by your advisor and/or Program of Study.

For instance, MS students in TRN are required to take a minimum of 12 courses post-BS plus thesis/analysis paper. For PhD students in TRN, admission to PhD candidacy, one additional year of customized courses and an MS thesis at NU or elsewhere are required. Students are required to take the following core courses: CIV\_ENV 479, 482, 483. Students must take 2 of the following: CIV\_ENV 376, 471-1,2, and one of the following: CIV\_ENV 480-1,2 as well as attend CIV\_ENV 517-1,2,3 – a required no-credit, no-tuition Seminar in Transportation Systems Analysis and Planning. Foundation courses are required from statistics, economics, operations research, and electives.

## D. SATISFACTORY ACADEMIC PROGRESS

*Environmental Engineering and Science:* The first element of evaluation is performance in course work, which is measured both by the student's grades and individual evaluations by professors. These are discussed in our EES group meetings. Students must maintain a 3.00, but those students whose GPA falls below 3.50 are given careful consideration before they are allowed to move on to research.

*Geotechnics:* All students must maintain a minimum GPA in accordance with Graduate School rules (3.00). Any students supported by Research Assistantship funding must satisfy project needs. Students will attend weekly group meetings. The required thesis must satisfy the principal advisor and at least one additional geotechnical reviewer.

*Mechanics of Materials and Solids:* All students must attend weekly meetings to discuss progress. In addition, each student is required to make monthly formal presentations to the entire group, where the results are discussed, debated, and criticized.

*Structural Engineering and Materials:* The first element of the evaluation is performance in course work, which is measured both by student's grades and individual evaluations by professors. Students must maintain a 3.00, but those students whose GPA falls below 3.7 are given careful consideration before they are allowed to move on to research.

*Transportation Systems Analysis and Planning:* Student must maintain a minimum GPA of 3.5 and a good performance on graduate course work, based on subjective assessment by all TRN faculty. For admission to the PhD program, students must pass a qualifying exam based on course work and research exercise with both oral and written components. Student must also have support of at least one faculty member to serve as the research advisor.

## E. CANDIDACY AND PROPOSAL DEFENSE

*Environmental Engineering and Science:* Each student must take a Prequalifying Exam at the end of the first year. This involves the preparation and presentation of a short research proposal before an examining committee. Students can only take this exam if they have

been accepted into a research group and have a thesis advisor. Upon passing this exam they are allowed to move into PhD candidacy and proceed with their research and to prepare for The Thesis Qualifying Exam (Prospectus—defending the proposed dissertation topic). The Thesis Qualifying Exam is taken in the second or third year, consisting of preparing and defending an extensive research proposal. Their committee determines if they are able to proceed with their proposed research.

*Geotechnics:* Upon completion of course work or the second year, students complete a written and oral Preliminary Qualifying Exam and formal written dissertation proposal (Prospectus). An External MS is counted as year one. Students must maintain a minimum GPA in accordance with TGS rules (3.00), and must pass the Qualifying Exam. This consists of a written exam, a comprehensive oral exam, and a written thesis proposal and presentation for a committee of at least three professors. Students will receive written guidelines and example schedules for qualifying exams as exam date approaches.

*Mechanics of Materials and Solids:* Students must take an oral qualifying exam, which is primarily an oral defense of the proposal before the PhD Qualifying Committee (Prospectus).

*Structural Engineering and Materials:* The PhD candidacy exam is typically taken at the end of the second or into the third year where students prepare and defend a research proposal before a committee (Prospectus).

*Transportation Systems Analysis and Planning:* At the end of the first academic year in the program, students take a comprehensive qualifying exam with written and oral components. The exam is intended to assess a student's proficiency in the field, as well as research potential. Satisfactory completion of the exam results in advancement to PhD Candidacy.

By the end of their third year in the program, students are expected to convene a committee and defend their dissertation proposal (Prospectus).

## F. DISSERTATION DEFENSE

*Environmental Engineering and Science:* PhD dissertation research and thesis writing typically takes 3-6 years. If a problem arises, students will be dealt with on a case-by-case basis. Students must provide an oral defense of their thesis before their dissertation committee, revise their thesis as advised, and receive the approval of each committee member.

*Geotechnics:* All students who are supported with Research Assistantship funding must satisfy continuing project needs. Meetings are required every or every other week with a supervisor as a group or individually. In addition, students must make one or two

presentations on thesis work at Geotechnical Seminars during the winter and spring quarters Average completion time is four to five years after BS.

*Mechanics of Materials and Solids:* Students must provide an oral defense with the PhD Final Committee.

*Structural Engineering and Materials:* PhD dissertation research and thesis-writing typically takes anywhere from 3-6 years. In most cases, students will complete their work, defend their thesis, and graduate.

*Transportation Systems Analysis and Planning:* Average completion time for dissertation is four to five years.

## Civil and Environmental Engineering MS and PhD Requirements by Program of Study

	<b>Environmental Engineering and Science</b>	<b>Geotechnics</b>	<b>Mechanics of Materials and Solids</b>	<b>Structural Engineering and Materials</b>	<b>Transportation Systems Analysis and Planning</b>
<b>Units</b>	Minimum of 12 courses (units) post-BS for MS. PhD students must complete a minimum of 9 courses post-BS.	Minimum of 10 courses plus research and thesis post- BS for MS. 18 courses post-BS or 12 courses post external MS toward PhD (excluding thesis).	Minimum of 11 courses (units) post-BS for MS. 18 courses post-BS, excluding theses and projects toward PhD.	Minimum of 11 courses (units) post-BS plus a thesis or project (2 units) for MS. At least 6 additional courses are typically taken for the PhD.	Minimum of 12 courses (units) post-BS plus thesis for MS. Required for admission to PhD Candidacy: One additional year of customized courses; An MS thesis, at NU or elsewhere.
<b>Course Work</b>	<u>Required 6 core courses:</u> CIV_ENV 361-1, 365, 367, 440, 444, 448; Plus three courses in a specialty: (Environmental Analytical Chemistry = CIV_ENV 447, 468, MAT_SCI 360); (Environmental Microbiology = CIV_ENV 441, 442, 443).	<u>Core courses:</u> CIV_ENV 450-1,2,3, 451, 358, and 3 of 355, 453, 454, 458. Plus courses in series of 3 or more to build one or two minor areas of study	<u>Core courses:</u> CIV_ENV 318, 327, 411, 413, 414-1, 2, 415, 417-1,2, 419, 426-1,2. Plus electives from: Mechanics of Materials and Solids, Structural Engineering and Materials, Engineering Sciences and Applied Mathematics, Mechanical Engineering, Material Science and Engineering	<u>Required courses:</u> CIV_ENV 306, 307, 320, 321, 422, 423, 424. Plus electives from: Mechanics of Materials and Solids, Structural Engineering and Materials, Engineering Sciences and Applied Mathematics, Mechanical Engineering, Material Science and Engineering	<u>Required core courses:</u> CIV_ENV 479, 482, 483 Two of three required: CIV_ENV 376, 471-1,2 One of two required: CIV_ENV 480-1,2 Foundation courses required from statistics, economics, operations research, plus electives

	<b>Environmental Engineering and Science</b>	<b>Geotechnics</b>	<b>Mechanics of Materials and Solids</b>	<b>Structural Engineering and Materials</b>	<b>Transportation Systems Analysis and Planning</b>
<b>Candidacy</b>	Preliminary Qualifying Exam at end of first year consists of writing and defending a short proposal on a subject chosen by faculty.	Written and oral Preliminary Qualifying Exam and formal written dissertation proposal after completion of course work or second year (Prospectus)  External MS is counted as year one.	Oral exam which is primarily a defense of the dissertation proposal (Prospectus).	Primarily a defense of the dissertation proposal (Prospectus).	At the end of the first academic year in the program students take a comprehensive qualifying exam with written and oral components. The exam is intended to assess a student's proficiency in the field, as well as research potential. Satisfactory completion of the exam results in advancement to PhD Candidacy.
<b>Prospectus (oral defense of dissertation research proposal)</b>	Prospectus is completed in the second or third year, consisting of writing and orally defending extensive Ph.D. research proposal with student's PhD Qualifying Committee.	Oral defense of Ph.D. research proposal with student's PhD Qualifying Committee.	Oral defense of Ph.D. research proposal with student's PhD Qualifying Committee.	Oral defense of Ph.D. research proposal with student's PhD Qualifying Committee.	By the end of their third year in the program, students are expected to convene a committee and defend their dissertation proposal.
<b>Dissertation</b>	Yes	Yes	Yes	Yes	Yes
<b>Dissertation Defense</b>	Oral defense with student's PhD Final Committee	Oral defense with student's PhD Final Committee	Oral defense with student's PhD Final Committee	Oral defense with student's PhD Final Committee	Oral defense with student's PhD Final Committee