

Department of Civil and Environmental Engineering

GRADUATE HANDBOOK

2019

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Department of Civil and Environmental Engineering
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PREAMBLE

This *Graduate Handbook* provides general information about the graduate programs in the Howard University Department of Civil and Environmental Engineering (CEE), and presents guidelines for completing graduate degree requirements. This Handbook should be viewed as a supplement to the Howard University Graduate School (GS) procedures, policies and requirements. If you need detailed information, consult with your academic advisor. Additional information about the CEE Department can be found on the Department webpage.

While the CEE Department Chair, CEE Graduate Director, CEE faculty members, and the GS can provide guidance, students must remember that responsibility for fulfilling the requirements for their degrees ultimately rests with them. Students must consult the GS website for deadlines and policies.

1. GRADUATE PROGRAM OVERVIEW

The Department of Civil and Environmental Engineering (CEE) at Howard University offers Master of Science (MS), Master of Engineering (MEng), and the Doctor of Philosophy (PhD) degrees. The graduate program within the CEE Department is composed of four sub-disciplines. Each entering graduate student must be accepted into a sub-discipline. The sub-disciplines are:

- Environmental and Water Resources Engineering
- Structural and Earthquake Engineering
- Transportation Engineering
- Geotechnical Engineering

The degrees awarded at the CEE Department are:

- MS with concentration in one of the sub-disciplines
- MEng with concentration in one of the sub-disciplines
- PhD in an interdisciplinary area with major emphasis on one of the sub-disciplines

The MS program is designed to complete in four semesters of full-time study, including summer research. Each MS student must complete a minimum of 30 semester hours: 24 credit hours of coursework and 6 credit hours of thesis research. The coursework requires the completion of core courses within the sub-discipline in which the student was accepted. MS students are encouraged to have at least one journal paper publication in a notably ranked journal before completing the MS program. MS candidates must also pass an oral and written examination of their research project (Thesis).

The MEng program may be completed in two semesters of full-time study. Each MEng student must complete a minimum of 30 semester hours: 27 credit hours coursework, and 3 credit hours of a research project. The coursework requires the completion of core courses of the sub-discipline in which the student was accepted. MEng candidates must also pass a comprehensive examination.

The PhD/Doctoral program is interdisciplinary and focuses on two interdisciplinary research thrusts:

- Environmental engineering (includes environmental and water resources engineering)
- Sustainable urban and global infrastructure (includes structures, geotechnical and transportation engineering).

Each doctoral student must complete a minimum of 72 hours beyond the Baccalaureate (BSc) degree. A doctoral student must complete a minimum of 48 credit hours at Howard University beyond the Master's degree and may transfer 24 course credit hours from the Master's degree to the PhD program to complete the total of 72 hours. The course requirements include 12 hours on a dissertation topic based on original research. The coursework requirements for the doctoral degree are designed by the academic advisor in accordance with both the sub-discipline and the interdisciplinary research area in which the student was accepted. However, the student is required to complete the core courses of the sub-discipline within the in which the student has been accepted. Doctoral students are highly encouraged to prepare and publish at least two papers in notably ranked journals before completing their program. They are encouraged to support the submission of external funding applications to agencies for sponsored research support.

2. REQUIREMENTS FOR ADMISSION

Admission to the graduate program is granted to the students who show the most promise as an active contributor to the civil and environmental engineering field and provide sufficient evidence for their potential to meet both high academic standards and excellent research performance. The CEE faculty graduate committee administers the final review for each candidate and provides a recommendation for or against admission to the Graduate School. Admission requirements for the graduate programs at CEE Department include those required by the Graduate School (GS), as well as the following departmental requirements:

MEng and MS programs: a minimum BSc GPA of 3.0

PhD program: a minimum GPA of 3.2

Financial resources may be available to support the highest qualified MS and PhD students.

3. GRADUATE PROGRAM GOALS AND VISON

The **goals** of the graduate degrees in the CEE Department are:

- To train and inspire a new generation of civil and environmental engineering graduates to solve complex problems regarding civil infrastructure and the natural and engineered environments.
- To offer an interdisciplinary PhD program for graduate education at Howard University that is technically grounded, but built around common thematic areas.

The CEE Department expects that graduate students follow the guiding principles:

- Graduates will understand the importance of sustainable systems, with the goal of minimizing environmental consequences of engineering decisions.
- Graduates will understand the appropriateness of engineering solutions for developed, developing, and underdeveloped nations.
- Graduates will be knowledgeable of the environmental, economic and social consequences of planned and built infrastructures.
- Graduates will understand the role of government, academia, industry, policy and business in managing the built and natural environment.
- Graduates will be engaged in research that could make a significant contribution to professional knowledge in the field.

The **vision** of the PhD program in the CEE Department is to integrate faculty, students and research thrust areas that involve the departments of the College of Engineering and Architecture (CEA) and a number of allied disciplines at Howard University. The main thrusts include:

- **Structural Mechanics Thrust:**
 - Department of Mechanical Engineering
 - Department of Electrical and Computer Engineering
 - Department of Mathematics
- **Environmental Thrust:**
 - Department of Biology
 - Department of Chemistry
 - Department of Mechanical Engineering
 - Department of Chemical Engineering
- **Transportation Thrust:**
 - Department of Electrical and Computer Engineering and Computer Science
 - Department of Mathematics
 - Department of Psychology
 - Department of Management
- **Materials Thrust:**
 - Department of Electrical and Computer Engineering and Computer Science
 - Department of Mechanical Engineering
 - Department of Chemistry
 - Department of Physics
 - Department of Chemical Engineering
- **Geotechnical Thrust:**
 - Department of Electrical and Computer Engineering and Computer Science
 - Department of Mechanical Engineering
 - Department of Physics

In addition to the required CEA courses of the program, students are encouraged to take additional courses in engineering education, business management, economics or public policy. These courses will be approved by the student's academic advisor.

4. PROGRAM COMPONENTS

4.1 Official graduate plan of study

At the beginning of the first semester, each entrant student should meet with the assigned academic advisor to design and formalize their *graduate plan of study*. The graduate plan of study is a personalized plan, based on the sub-discipline describing the completion of the envisioned program. The plan of study should include the completion of the core requirements of the sub-discipline in which the student was accepted. This plan is developed by the student and the academic advisor. It is the student's responsibility to obtain the appropriate signatures to formalize the study plan which will be added to his/her file in the CEE Department and the GS. Any modification to this study plan requires the approval and signatures of the academic advisor and the CEE Department Chair.

4.2 Comprehensive examination for MEng students

Each MEng candidate is required to pass a comprehensive examination with a minimum score of 80/100. The comprehensive examination must be taken only when all course requirements for the MEng program have been completed with a minimum GPA of 3.0. Content for the comprehensive examination includes all the course materials the student is using for graduation (courses taken at Howard University, transferred courses, and courses taken at the Consortium) with focus, but not limited to the core courses of the sub-discipline. It is the student's responsibility to initiate the exam procedure by filling out the appropriate form (*Application to Schedule a Comprehensive Examination*) and submitting this form to the academic advisor. The academic advisor will coordinate with the CEE Department Chair to form a committee to prepare and administer the examination. The comprehensive examination committee will be composed of a minimum of three faculty members including the student's academic advisor and two faculty members who have instructed the student in the graduate program. Comprehensive examinations for MEng students in the CEE Department are held **once a semester**. If the student fails the examination the first time, the student can retake the exam only one more time. Any student who fails the examination for the second time will be dismissed from the program.

4.3 MS Thesis

All MS candidates must complete an approved research project that demonstrates his or her ability to conduct original, independent research that constitutes a distinct contribution to knowledge in the principal field of study. MS students are required to pass a final oral and written examination (thesis). CEE students should follow the GS procedures, policies and requirements for the thesis and the corresponding defense/oral examination. This procedure is aligned with the GS policies found at <https://gs.howard.edu/students/rules-and-regulations/article-v-general-requirements-masters-degrees>

4.4 Qualifying Examination (PhD students)

4.4.1. *Written Portion*. The written qualifying examination is a first in the series of three PhD examinations followed by an oral qualifying examination and a final oral defense of the dissertation near the completion of the degree. The content and structure of qualifying examination varies by sub-discipline and interdisciplinary research area. The written qualifying examination will be prepared and administrated by an examination committee chaired by the student's primary advisor. The written qualifying examination can be taken only when (1) a doctoral student holding a Master's degree has completed three (3) semesters as a full-time student completing the course requirements; and (2) a doctoral student holding only a Baccalaureate degree has completed five (5) semesters as a full-time student completing the course requirements. To take the written qualifying examination, the doctoral student must have a minimum GPA of 3.5. Students are required to pass the qualifying examination with a minimum score of 80%. The examination will be offered only once each semester. Any student who fails the examination for a second time will not be allowed to continue their study in the GS. It is the student's responsibility to request their academic advisor to begin the procedure by filling out the *application of intent to complete qualifying examination & faculty approval form* before the qualifying registration deadline set by the CEE Department. The examination committee is convened by the academic advisor, the CEE Director of Graduate Studies, and the CEE Department Chair. The academic advisor will coordinate with the Director of Graduate Studies and the CEE Department Chair for the administration of the exam. This procedure is aligned with the GS policies found at <https://gs.howard.edu/academics/rules-and-regulations/article-vi-general-requirements->

[doctor-philosophy-degree](#)

A PhD student can register for dissertation credits only after the student has completed core course work (24 MS + 36 PhD courses, or 60 courses post BS).

4.4.2. *Oral Portion.* The oral qualifying examination may be taken when all core course requirements for the PhD program have been completed, and within one year after the student has passed the written qualifying examination. This is the second screening examination which encompasses the early portion of the student's program and establishes that the student is of doctoral quality and capable of doing research at this level. This is an opportunity for the doctoral committee to inform PhD students about their strengths and weaknesses and the likelihood of their successful completion of the requirements for the doctorate. The nature and content of the examination are at the discretion of the doctoral committee. This examination may include a broad inquiry into the student's preparation for research and the opportunity in which the doctoral committee also reviews the dissertation proposal. Prior to the oral qualifying examination, a dissertation proposal must be submitted to the doctoral committee at least two (2) weeks in advance. Students will propose an examination committee in advance of taking the doctoral oral qualifying examination. The CEE Department will authorize and formalize the nomination of the selected examination committee which will be submitted to the GS for approval. The examination committee at this level consists of a minimum of four internal (HU) faculty members that will serve on the dissertation committee. Students must be registered and enrolled during the semester they plan to take the doctoral oral qualifying examination.

4.6 Admission to candidacy

A student can be admitted to candidacy for the PhD degree if that student has fulfilled all the candidacy requirements of the GS including the completion of the final version of the dissertation proposal approved during the PhD oral qualifying examination (<https://gs.howard.edu/academics/rules-and-regulations/article-vi-general-requirements-doctor-philosophy-degree>).

4.7 Dissertation and final oral examination

All doctoral students are required to complete an approved dissertation that demonstrates their ability to perform original, independent research and constitute a distinct contribution to knowledge in the principal field of study. Doctoral students are required to defend the dissertation work in a final oral examination following of procedures established by the GS. The examination committee is conformed as required by the GS. The CEE graduate students should follow the GS procedures, policies and requirements for dissertation and the final oral examination (<https://gs.howard.edu/academics/rules-and-regulations/article-vi-general-requirements-doctor-philosophy-degree>).

4.8 Conference presentations

All graduate students in the CEE Department are highly encouraged to present research findings at regional and national conferences. The conference presentations offer many opportunities: to present research findings during the different stages of development and to receive feedback from colleagues, to learn from cutting-edge researchers, to enhance the overall research profile, and provide the chance to meet other researchers in the field and potential contacts for future job opportunities. All graduate students in the CEE Department are encouraged to plan with their advisors the conference presentations they intend to give each academic year. Graduate students are encouraged to be familiar with the procedures to apply for partial/full support from the GS for conference presentations.

4.9 Journal publications

All graduate students in the CEE Graduate Program are highly encouraged to publish at least two papers in a notably ranked journals in their sub-discipline before completing the graduate program.

5. DEGREE REQUIREMENTS

5.1 Class registration

Each semester, Howard University issues a calendar for registration for the next academic semester. It is the student's responsibility to meet the academic advisor and define the academic schedule for the coming

semester. This meeting is formalized with completion of the *CEE graduate advising form* that should be signed by both the academic advisor and student before registration. It is the student's responsibility to obtain the corresponding signatures on the form to be added to his/her file at the CEE Department. **Students cannot make any modifications to the approved course schedule without the consent of their academic advisor.**

5.2 Provisional admission

At the discretion of the CEE faculty graduate committee, provisional admission may be recommended. In this case, a provision must be met before the student is awarded full admission to the program. Any student who fails to complete the stipulation for provisional acceptance by the specified deadline will not be allowed to continue his/her graduate studies.

5.3 Course requirements

Tables 1 through 8 present the credit hours requirements for the MS and MEng programs. Tables 9 through 12 present the course requirements for the PhD program. The student is expected to consider courses offered through the Consortium (<http://www.consortium.org/>) to complete the course requirements. The Consortium courses must be pre-approved by the academic advisor and the CEE Department Chair.

6. GRADUATE ACADEMIC ADVISORS AND ADVISORY/EXAMINATION COMMITTEES

A student's academic advisor typically works with the student to design the graduate plan of study, approves the plan of study, provides advice, coordinates the logistics for required examinations and regularly assesses the student's progress and accomplishments. Academic advisors are assigned based on the CEE sub-disciplines by the CEE Department Chair and CEE Graduate Director.

All graduate programs in the CEE Department will need the support of advisory or examination committees at different stages of the programs. Advisory/examination committees for the Master programs, and for qualifying examinations for the doctoral program are recommended by the students (with consultation with the advisor) and approved by CEE Department Chair and the CEE Graduate Director. The formalizing of the graduate plan of study requires the listing the proposed committee members and the description of the purpose of the committee. For dissertation and the final oral examination committee members for the PhD program, the CEE Department Chair and the CEE Graduate Director will recommend the committee members to the GS following the GS procedures, policies and requirements.

Changes in a student's academic advisor will be granted only upon approval of both the new and old academic advisors, based on the recommendation of the CEE Graduate Director and the CEE Department Chair.

Changes in a student's advisory/examination committee will be granted only upon the approval of all committee members, new and old members, based on the recommendation by the CEE Graduate Director or CEE Department Chair.

Table 1. Requirements for MS in Environmental and Water Resources (similar courses approved by the advisor may be taken at the Consortium or within the University)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/ Environmental and Water Resources	MS./thesis	24	0	6	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG511 or CUGW CE 6501		Environmental Chemistry		3	
BIOL424		Environmental Microbiology		3	
CIEG502		Physical/Chemical Process for Water Treatment		3	
CIEG501		Biological Processes for Wastewater Treatment		3	
CIEG557		Advanced Hydrology		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CHEG412/501		Transport Phenomena		3	
CUGW CE6505		Environmental Impact Assessment		3	
CUGW CE6509		Introduction to Hazardous Waste		3	
CIEG 553		Environmental Engineering Project Research		3	
SPECIAL Courses (Special Projects, Seminar, Research, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 561		Thesis		6	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Expository Writing Requirement
3. Responsible Conduct of Research (RCR) Training
4. Thesis Proposal
5. Thesis Defense
6. Thesis Uploaded to ProQuest

Table 2. Requirements for MEng in Environmental and Water Resources (similar courses approved by the advisor may be taken at the Consortium or within the University)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for Research (Independent, Supervised, or Directed)	Credit Hours for Thesis or Dissertation Research	Total Number of Credit Hours - Minimum Required
Civil Engineering/ Environmental and Water Resources	M.Eng./non- thesis	30	0	0	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG511 or CUGW CE 6501		Environmental Chemistry		3	
BIOL424		Environmental Microbiology		3	
CIEG502		Physical/Chemical Process for Water Treatment		3	
CIEG501		Biological Processes for Wastewater Treatment		3	
CIEG557		Advanced Hydrology		3	
CHEG412/501		Transport Phenomena		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CHEG412/501		Transport Phenomena		3	
CUGW CE6505		Environmental Impact Assessment		3	
CUGW CE6509		Introduction to Hazardous Waste		3	
CUGW CE6601		Open Channel Flow		3	
SPECIAL Courses (Thesis, Dissertation, Seminar, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 553		Environmental Engineering Project Research		3	

Completion/Approval of the following requirements:

1. Elective Courses may vary. Selection of Elective Courses needs Advisor's approval
2. Comprehensive Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training

Table 3. Requirements for MS Structural Mechanics and Earthquake Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Structural Mechanics	MS/with thesis	24	0	6	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 513		Advanced Structural Analysis (Matrix Structural Analysis or equivalent)		3	
CIEG 514		Finite Element Analysis		3	
CUGW CE 6301		Advanced Reinforced Concrete Design		3	
CUGW CE <u>6320</u>		Advanced Steel Design		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 529		Introduction to Structural Protective Systems		3	
CIEG 555		Structures Research Project		3	
CIEG 500		Special Topics in Structures		3	
CIEG 603		Adv. Foundation Engineering		3	
SPECIAL Courses (Special Projects, Seminar, Research, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 561		Thesis		6	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Expository Writing Requirement
3. Responsible Conduct of Research (RCR) Training
4. Thesis Proposal
5. Thesis Defense
6. Thesis Uploaded to ProQuest

Table 4. Requirements for MEng Structural Mechanics and Earthquake Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or</u> <u>Dissertation</u> <u>Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Structural Mechanics	M.Eng./non- thesis	30	0	0	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 513		Advanced Structural Analysis (Matrix Structural Analysis or equivalent)		3	
CIEG 514		Finite Element Analysis		3	
CUGW CE 6301		Advanced Reinforced Concrete Design		3	
CUGW CE <u>6320</u>		Advanced Steel Design		3	
CIEG 555		Structures Research Project		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 529		Introduction to Structural Protective Systems		3	
CIEG 500		Special Topics in Structures		3	
CIEG 603		Adv. Foundation Engineering		3	
CUGW CE <u>6340</u>		Structural dynamics		3	
CUGW CE <u>6302</u>		Pre-stressed Concrete Structures		3	

Completion/Approval of the following requirements:

1. Elective Courses may vary. Selection of Elective Courses needs Advisor's approval
2. Comprehensive Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training

Table 5. Core Course Requirements for MS in Transportation Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Transportation Engineering	MS/thesis	24	0	6	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 579		Advanced Traffic Engineering		3	
CIEG 507		Traffic Flow Theory		3	
CIEG 504		Intelligent Transportation Systems		3	
CIEG 466		Traffic Engineering II		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 620		Transportation Systems Modeling and Analysis		3	
CIEG 619		Urban Transit Planning		3	
CIEG 567		Construction Project Management		3	
CIEG 544		Transportation Engineering Research		3	
SPECIAL Courses (Special Projects, Seminar, Research, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 561		Thesis		6	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Expository Writing Requirement
3. Responsible Conduct of Research (RCR) Training
4. Thesis Proposal
5. Thesis Defense
6. Thesis Uploaded to ProQuest

Table 6. Core Course Requirements for MEng in Transportation Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for Research (Independent, Supervised, or Directed)	Credit Hours for Thesis or Dissertation Research	Total Number of Credit Hours - Minimum Required
Civil Engineering/ Transportation Engineering	M.Eng./non- thesis	30	0	0	30
CORE Courses:					
Subject Code & Course Number	Course Title		Credit Hours		
CIEG 579	Advanced Traffic Engineering		3		
CIEG 507	Traffic Flow Theory		3		
CIEG 504	Intelligent Transportation Systems		3		
CIEG 466	Traffic Engineering II		3		
CIEG 544	Transportation Engineering Research		3		
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number	Course Title		Credit Hours		
CIEG 620	Transportation Systems Modeling and Analysis		3		
CIEG 619	Urban Transit Planning		3		
CIEG 567	Construction Project Management		3		
CIEG 618	Transportation Engineering Project		3		
HUDE 400	Intermediate Statistics		3		

Completion/Approval of the following requirements:

1. Elective Courses may vary. Selection of Elective Courses needs Advisor's approval
2. Comprehensive Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training

Table 7. Core Course Requirements for MS in Geotechnical Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Geotechnical	MS/ with thesis	24	0	6	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 600		Advanced Soil Mechanics		3	
CIEG 603		Advanced Foundation Engineering		3	
CIEG 514		Finite Element Analysis		3	
UMD ENCE741		Earth Retaining Structures		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
UMD ENCE743		Soil Dynamics and Earthquake Engineering		3	
PHYS-192		Math Methods in Physics I		3	
CIEG 616		Advanced Optimization		3	
CIEG 605		Research Methods		3	
SPECIAL Courses (Special Projects, Seminar, Research, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 561		Thesis		6	

Completion/Approval of the following requirements:

1. Elective Courses may vary with Research Topic. Selection of Elective Courses Needs Advisor's Approval.
2. Expository Writing Requirement
3. Responsible Conduct of Research (RCR) Training
4. Thesis Proposal
5. Thesis Defense
6. Thesis Uploaded to ProQuest

Table 8. Core Course Requirements for MEng in Geotechnical Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for Research (Independent, Supervised, or Directed)	Credit Hours for Thesis or Dissertation Research	Total Number of Credit Hours - Minimum Required
Civil Engineering/Geotechnical	M.Eng./non- thesis	30	0	0	30
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 600		Advanced Soil Mechanics		3	
CIEG 603		Advanced Foundation Engineering		3	
CIEG 514		Finite Element Analysis		3	
UMD ENCE741		Earth Retaining Structures		3	
GMU CEIE 634		Groundwater and Geoenvironmental Design		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
UMD ENCE743		Soil Dynamics and Earthquake Engineering		3	
PHYS-192		Math Methods in Physics I		3	
CIEG 616		Advanced Optimization		3	
CIEG 605		Research Methods		3	
CIEG 614		Special Topics in Geotechnical Engineering I		3	

Completion/Approval of the following requirements:

1. Elective Courses may vary. Selection of Elective Courses Needs Advisor's Approval.
2. Comprehensive Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training

Table 9. Requirements for PhD in Environmental and Water Resources (similar courses approved by the advisor may be taken at the Consortium or within the University)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/ Environmental and Water Resources	Ph.D.	60	0	12	72
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG511 or CUGW CE 6501		Environmental Chemistry		3	
BIOL424		Environmental Microbiology		3	
CIEG502		Physical/Chemical Process for Water Treatment		3	
CIEG501		Biological Processes for Wastewater Treatment		3	
CIEG557		Advanced Hydrology		3	
CHEG412/501		Transport Phenomena		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CHEG412/501		Transport Phenomena		3	
CUGW CE6505		Environmental Impact Assessment		3	
CUGW CE6509		Introduction to Hazardous Waste		3	
CUGW CE6601		Open Channel Flow		3	
CHEM 251		General Biochemistry		3	
BIOG 415		Molecular genetics		3	
CIEG 553		Environmental Engineering Project Research		3	
SPECIAL Courses (Thesis, Dissertation, Seminar, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 608		Dissertation Research		12	
ADDITIONAL Courses:					
		Course Title		Credit Hours	
		Transferred courses from MS or ME or 8 additional ELECTIVES(3 credits each)		24	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Qualifying Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training
5. Mandatory Research Review
6. Dissertation Proposal
7. Admission to Candidacy
8. Dissertation Defense
9. Dissertation Uploaded to ProQuest

Table 10. Requirements for PhD Structural Mechanics and Earthquake Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Structural Mechanics	Ph.D.	60	0	12	72
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 513		Advanced Structural Analysis (Matrix Structural Analysis or equivalent)		3	
CIEG 514		Finite Element Analysis		3	
CUGW CE 6301		Advanced Reinforced Concrete Design		3	
CUGW CE <u>6320</u>		Advanced Steel Design		3	
CIEG 555		Structures Research Project		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 529		Introduction to Structural Protective Systems		3	
CIEG 500		Special Topics in Structures		3	
CIEG 603		Adv. Foundation Engineering		3	
CUGW CE <u>6340</u>		Structural dynamics		3	
CUGW CE <u>6302</u>		Pre-stressed Concrete Structures		3	
CIEG 509		Structures Research Project II		3	
CIEG 622		Earthquake Engineering Research I		3	
SPECIAL Courses (Thesis, Dissertation, Seminar, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 608		Dissertation Research		12	
ADDITIONAL Courses:					
		Course Title		Credit Hours	
		Transferred courses from MS or ME or 8 additional ELECTIVES(3 credits each)		24	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Qualifying Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training
5. Mandatory Research Review
6. Dissertation Proposal
7. Admission to Candidacy
8. Dissertation Defense
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Table 11. Core Course Requirements for PhD in Transportation Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours -Minimum Required
Civil Engineering/ Transportation Engineering	Ph.D.	60	0	12	72
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 579		Advanced Traffic Engineering		3	
CIEG 507		Traffic Flow Theory		3	
CIEG 504		Intelligent Transportation Systems		3	
CIEG 466		Traffic Engineering II		3	
CIEG 544		Transportation Engineering Research		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 620		Transportation Systems Modeling and Analysis		3	
CIEG 619		Urban Transit Planning		3	
CIEG 567		Construction Project Management		3	
CIEG 618		Transportation Engineering Project		3	
EECE 502		Engineering Analysis A		3	
HUDE 400		Intermediate Statistics		3	
HUDE 500		Advanced Statistics		3	
SPECIAL Courses (Thesis, Dissertation, Seminar, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 608		Dissertation Research		12	
ADDITIONAL Courses:					
		Course Title		Credit Hours	
		Transferred courses from MS or ME or 8 additional ELECTIVES(3 credits each)		24	

Completion/Approval of the following requirements:

1. Elective Courses may vary with research topic. Selection of Elective Courses needs Advisor's approval.
2. Qualifying Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training
5. Mandatory Research Review
6. Dissertation Proposal
7. Admission to Candidacy
8. Dissertation Defense
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Table 12. Core Course Requirements for PhD in Geotechnical Engineering (similar courses approved by the advisor may be taken at the Consortium)

Field of Study/ Specialization	Degree Program	Coursework Credit Hours	Credit Hours for <u>Research</u> (Independent, Supervised, or Directed)	Credit Hours for <u>Thesis or Dissertation Research</u>	Total Number of Credit Hours - Minimum Required
Civil Engineering/Geotechnical	Ph.D.	60	0	12	72
CORE Courses:					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 600		Advanced Soil Mechanics		3	
CIEG 603		Advanced Foundation Engineering		3	
CIEG 514		Finite Element Analysis		3	
UMD ENCE741		Earth Retaining Structures		3	
GMU CEIE 634		Groundwater and Geoenvironmental Design		3	
MAJOR Courses (ELECTIVES):					
Subject Code & Course Number		Course Title		Credit Hours	
UMD ENCE743		Soil Dynamics and Earthquake Engineering		3	
PHYS-192		Math Methods in Physics I		3	
UMD ENCE647		Slope Stability and Seepage		3	
CIEG 616		Advanced Optimization		3	
CIEG 605		Research Methods		3	
CIEG 614		Special Topics in Geotechnical Engineering I		3	
CIEG 615		Special Topics in Geotechnical Engineering II		3	
SPECIAL Courses (Thesis, Dissertation, Seminar, etc.):					
Subject Code & Course Number		Course Title		Credit Hours	
CIEG 608		Dissertation Research		12	
ADDITIONAL Courses:					
		Course Title		Credit Hours	
		Transferred courses from MS or ME or 8 additional ELECTIVES (3 credits each)		24	

Completion/Approval of the following requirements:

1. Elective Courses may vary with Research Topic. Selection of Elective Courses Needs Advisor's Approval
2. Qualifying Exam
3. Expository Writing Requirement
4. Responsible Conduct of Research (RCR) Training
5. Mandatory Research Review
6. Dissertation Proposal
7. Admission to Candidacy
8. Dissertation Defense
9. Dissertation Uploaded to ProQuest

7. UNIVERSITY RESOURCE

- <https://calendar.howard.edu/>
- <http://www.gs.howard.edu/default.html>
- <https://www.howard.edu/students/hbook/H-Book.pdf>
- <http://www.howard.edu/secretary/documents/StudentCodeofConductApprovedApril182015.pdf>
- <http://www.howard.edu/financialaid/basics.htm>
- <http://www.howard.edu/studentfinancialservices/>
- https://bisonweb.howard.edu/PROD/bwckschd.p_disp_dyn_sched (class search)
- <http://www2.howard.edu/withdrawal> (total class withdrawal)
- <http://www.provost.howard.edu/Policy/GradProfCreditHourPolicy.pdf>
- <http://huhealthcare.com/healthcare/students>
- <http://www.provost.howard.edu/Policy/HUArticulationAgreement.pdf>
- <http://gs.howard.edu/gradrequirements.html>
- <http://www.gs.howard.edu/announcements/HowardUniversityTitleIXPolicy.pdf>
- <http://www.howard.edu/enrollment/exchange/cuwma.htm>
- <http://www.gs.howard.edu/pass/default.html> (Program for Academic Support Services located in the Graduate School)
- <http://www.gs.howard.edu/gradrequirements.html>
- http://www.gs.howard.edu/formandapplications/program_of_study.pdf (Doctoral Program of Study Form)
- http://www.gs.howard.edu/formandapplications/masters_pos.pdf (Master's Program of Student Form)
- http://www.howard.edu/bisonweb/documents/StudentReferenceManual_17072013.pdf