Steps to a Doctoral Degree in CEE
[September Start of Degree Progress]

1. Begin planning Doctoral Program with academic advisor [Fall Academic Year 1 (AY1)]
2. Approval of **Doctoral Program** and admission to general exam through **Student Interview** [Fall AY2]
3. Selection of Exam Committee and Scheduling of **General Exam Part 2** for April or May AY2 [scheduling done in January AY2]
4. Complete **General Exam Part 1 and Part 2** [by end of AY2]
5. Complete **Responsible Conduct of Research** course [by end of AY2]
6. Formation of Doctoral Thesis Committee following completion of General Exam
7. **Approval of Doctoral Research Proposal** [by Dec. 31, AY3]
8. Meet regularly [minimum of once per academic year] with Doctoral Thesis Committee
9. Doctoral Degree earned with satisfactory defense of the Ph.D. thesis [AY 5 or 6].

Doctoral Program
A Doctoral Program in CEE consists of **96 units** of graduate level coursework, including a **3-Subject Core (33-36 units)** and one breadth subject. The student should consult their faculty advisor when preparing their Doctoral Program. The **3-Subject Core** reflects core knowledge in the student's chosen field, which is tested in **Part 1 of the General Exam** (below). The three subjects are selected from an approved list of 4 to 5 subjects within a specific sub-group of CEE. The approved subjects are included at the end of this document and are also available at https://cee.mit.edu/resources/.

The remainder of the doctoral program consists of graduate subjects that complement the Core. In addition, the Doctoral Program must include one breadth subject; it is recommended that the CEE Professional Development Seminar (1.976, 6 units) serve this purpose, and that it be taken in your second year. The Doctoral Program may incorporate subjects completed during a CEE Masters degree. The Doctoral Program form can be downloaded from the CEE web site https://cee.mit.edu/resources/.

Transfer Credit
Up to 24 units of **graduate** credit taken outside MIT may be transferred to the CEE Doctoral Program. All transfer credits must be related to the core research area, and cannot be counted as your breadth. The Academic Programs Office approves transfer credits. To request transfer units, submit the following to the Academic Program Office: 1) syllabus, 2) one or more assignments, 3) transcript, 4) a statement that explains how the course is related to your research core, and 5) approval from your advisor (an email is fine). This package must be submitted to the Academic Program Office within 2 weeks of the start of the Fall semester of your second year.

Thesis Supervision
A student's thesis supervisor can be 1/MIT CEE Faculty member(s), 2/CEE Senior Research Scientist/Engineer, 3/ co-advised by a CEE and other MIT faculty member, 4/WHOI Scientist with an MIT CEE faculty advisor (Joint Program students only). A thesis supervisor is responsible for certifying and signing the thesis. In the case of co-supervisors, both must certify and sign thesis

Emeritus faculty
Emeritus faculty can be involved in mentorship of graduate students at their discretion, without compensation. They can serve as co-advisors as long as there is a primary advisor who will provide funding and who is actively engaged in supervising the student. It is acceptable for emeritus faculty to serve as PhD committee chair.

Research Requirement and 1.THG
1.THG is a subject associated with a program of research leading to the writing of a graduate thesis. Research plays an integral role in the graduate degree, and research effort is tracked through

enrollment in 1.THG. This subject is associated with the laboratory, field, computational, or theoretical research undertaken by each student working with a faculty advisor in CEE at MIT.

Graduate students are required to register for 1.THG every semester, and as part of this, meet with their supervisors on a regular basis. First-year students are required to register for 24 units of 1.THG and should meet with their supervisors on a weekly basis. Beyond first year, the number of credit hours is determined in consultation with your advisor. If a student is registered only for 1.THG during a term, the department recommends a load of 48 units. Through enrollment in 1.THG, students are formally graded on research performance each semester, in accordance with MIT Faculty Rules and Regulations 2.62.3.
http://facultygovernance.mit.edu/rules-and-regulations

CEE Graduate Student Annual Review of 1.THG
The annual review is an opportunity for (1) advisors to provide formal feedback (both positive and negative) on student performance and progress toward graduation and (2) for students to discuss their professional development goals, and to provide positive and negative feedback on their mentoring needs, and/or group climate. In particular, the questions here are designed to promote self-reflection and to facilitate an annual conversation between a faculty advisor and a graduate advisee. The annual review meeting will occur in the spring term, and is associated with the 1.THG grade for that term. The student and advisor submit a signed form to attest that a meeting has occurred, but the review itself remains confidential between student and advisor to promote frank feedback and discussion.

Application for Bridge Funding
Bridge funding is one semester of financial support (stipend+tuition) intended to support a graduate student's transition from one research group to another to complete their PhD. This funding is not guaranteed, and is allocated on an *individual* basis. Students who would like to be considered for bridge funding must be in good academic standing. Bridge funding is primarily made available to students aiming to transition research groups prior to their thesis proposal. To initiate such a request please make an appointment with the Academic Administrator.

Student Interview [Fall Term AY2]
During the Fall term, second year students are sent an email from the Graduate Academic Administrator (Kiley Clapper) announcing the upcoming Student Interview and requesting them to indicate if they wish to participate. Students select which of the two interviews to attend by contacting the appropriate Doctoral Program Officer listed below. Approval of the Doctoral Program and admittance to the General Exam are based on a review of academic and research performance. Students are expected to have a GPA ≥ 4.5 to be considered for the General Exam. The Student Interview is held with a group of faculty and research staff, organized by research area (see below).

A minimum of one week before the Student Interview, the following should be submitted to one of the following Doctoral Program Officers

Prof. Heidi Nepf – Environmental Science and Engineering, CSE
hmnepf@mit.edu
Prof. Oral Buyukozturk - Mechanics of Materials, Structures, Geomechanics, Systems, CSE
obuyuk@mit.edu

1) A one-page summary of proposed doctoral research written for a general scientific audience. Clearly enunciate how your research will build on the current state of knowledge in your field and the potential impact of your research on a broader societal issue.
2) The Doctoral Program form with advisor signature. Be sure to make a copy for your records.
3) A form from the research advisor stating the student's strengths and weaknesses, and stating whether, or not, they support admission to the General Exam. If the advisor supports admission to

the General Exam, they should also indicate willingness to supervise the student for the proposed doctoral work and willingness to provide and/or seek funding necessary for the duration of the degree. This form is submitted by the faculty advisor to the Academic Program Office.

At the interview, the student briefly describes the research they plan to pursue, explaining how the proposed set of subjects supports their research and career plans. The student will also identify their breadth class. Faculty may give advice on classes to add or take away from the proposed Doctoral Program. After the student leaves the room, there is a 5 to 10 minute discussion, beginning with a reading of the faculty advisor letter. At the end of the discussion, a formal recommendation is made to admit or decline the student for the General Exam, and the recommendation may include formal requirements to alter the Doctoral Program.

After the Student Interviews: The Academic Administrator [Kiley Clapper] will confer with the Doctoral Program Officers to review decisions and recommendations made by the faculty. The Academic Administrator will 1) send an email (with copy to advisor and Doctoral Program Officer) to the student with the outcome, admit or decline, and any recommendation by the faculty; and 2) send the hard-copies of the research summaries and Doctoral Program forms to the respective program Officers, and 3) collect signature from the Graduate Program Chair.

Once the Doctoral Program form has been submitted, students may not change their selection of Core subjects. Exceptions are rarely permitted, and require approval by the Graduate Program Chair. The remaining subjects in the Doctoral Program may be altered, with approval from the doctoral thesis committee. A Petition for Revision of Doctoral Program is available at the CEE grad-forms web site - https://cee.mit.edu/resources/.

Summer Tuition Subsidy

Graduate students who are enrolled in a research degree program and who are *not* taking subjects are eligible to have their summer tuition subsidized from Institute general funds.

The subsidy applies to new or continuing graduate students in normal resident status during the preceding spring term, and who are only registered for thesis or pre-thesis research credit during the summer.

Some key points to remember:

- Graduate students who register for other summer subjects will be charged tuition on a per unit basis up to the maximum tuition.
- Students registering for summer internship subjects are not eligible for the tuition subsidy and will be charged the per unit rate, up to a maximum of four units.
- Be sure to confirm with your advisor before registering for any summer subjects.

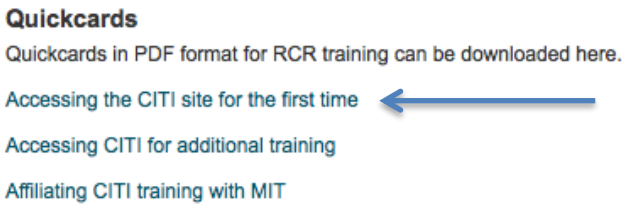
Tuition rates can be found here: https://registrar.mit.edu/registration-academics/tuition-fees/graduate

Responsible Conduct of Research

Each PhD student is required to complete MIT's online course on the Responsible Conduct of Research within the first two years, i.e. by Spring term of AY2. If you are paid on an NSF grant, you are required to complete the course within 60 days of being assigned to the grant. You can access the course from this web site and following the instructions below. You will need an MIT certificate.

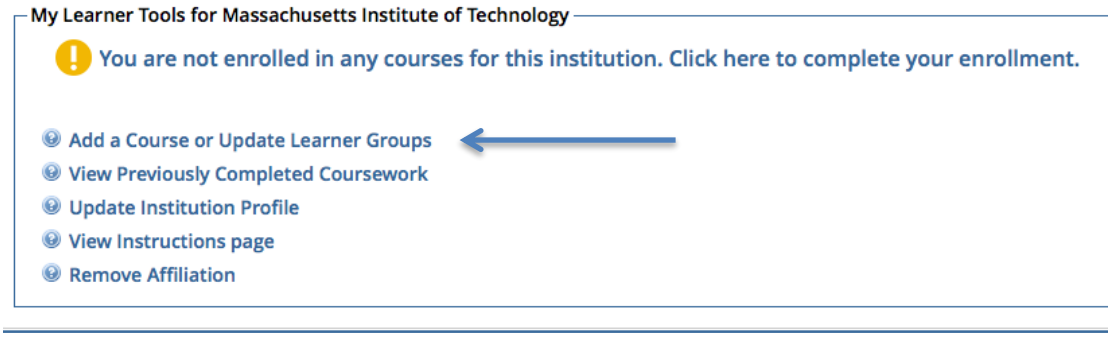
http://osp.mit.edu/compliance/responsible-conduct-research/take-training

1. On the bottom of the page, click on “accessing the site for the first time”



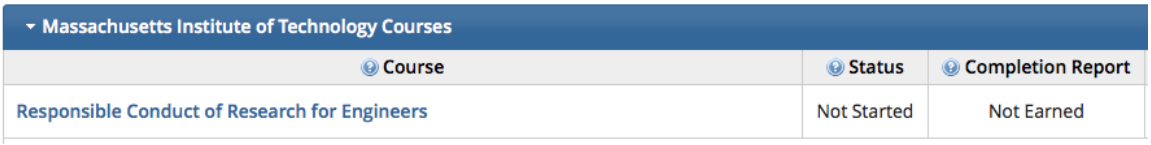
2. From there CITI will ask you to create a password.

3. After you have created your new password, click on “Add a course or Update Learner Group”



4. Go to question 4 and select, RCR for Engineers

5. You should then see that the course has been added



6. Complete The Integrity Assurance Statement before beginning the course

7. Once you have completed the course (12 modules with 80% or better on the individual quizzes) send a screen shot of your completion report to the graduate academic administrator, Kiley Clapper (kclapper@mit.edu).

General Exam Part 1 [Core Knowledge]

The General Exam Part 1 tests core knowledge within the selected field of study, as represented by the **3-Subject Core**. To pass General Exam Part 1, the student must receive a grade of A (including A-) in each of the subjects selected for the Core. The subjects identified in the 3-Subject Core are firm and rarely are exceptions permitted. In the circumstance where a subject is not offered for two consecutive academic years and there are no other options within the 3-Subject core list, a comparable level graduate subject may be substituted with approval from a student’s advisor. The process for substitution is a memo, that includes the rationale for the substitution and the advisor’s signature of approval, which is reviewed by the CEE faculty during the Student Interview.

In the circumstances of a "Significant Disruption" of academic activities where alternate grades (PE, NE, and IE) are put in affect for relevant core classes (e.g. during covid-19 pandemic), when possible a memo from the class instructor describing whether the student has mastered the subject material will be accepted by the department in lieu of official grading. If this is not possible, the student will have an additional opportunity to complete a written exam.

If the student receives a grade less than A, they have three options: 1) re-take the subject to improve the grade, 2) retake the final exam of that subject the next time it is offered, or 3) take and pass a separate written exam. The choice between 2) and 3) is at the discretion of the instructor. If 3) is chosen, the instructor prepares the written exam. The instructor decides the appropriate length (not to exceed eight hours) and format of the exam. During the written exam, the student may not request information from anyone other than the instructor and may not use information from the internet. All texts used by the student must be cited. The written exam should be completed a minimum of one full term after the original subject was taken, to allow time to study the material more deeply and improve understating. If the instructor is not a member of CEE and declines to provide a question, a CEE faculty or Senior Research Staff in the appropriate area will write the exam.

General Exam Part 2 [Research Aptitude]

This exam tests the following skills. First, can the student formulate a research question, set out a plan of research, and interpret the results. Second, can the student clearly present and defend this research. Third, does the student have sufficient understanding of the field to answer a broad range of questions and to comment on relevant literature. The research presented by the student can be drawn from their SM or MEng thesis, their current RA at MIT, or research conducted as part of a previous position. The research must be in the same field as the subgroup core listed in the Doctoral Program.

Part 2 of the General Exam must be completed by the end of the fourth academic term. In most cases, this exam occurs in April or May of AY2. Students should consult their research advisors when choosing the members of the evaluation committee (see requirements below). Your Part 2 general exam committee should be similar or identical to the thesis committee. Students *must* submit the Part 2 Schedule Form [available at https://cee.mit.edu/resources/] before the beginning of the term in which the exam will be held, which is the end of January for exams on April/May of AY2.

The exam has three components.

1) A written document describing research completed.
2) A review of a relevant publication chosen by your advisor. The paper will be assigned one week before the presentation meeting.
3) A 30-minute oral presentation of research with significant questioning from committee.

Research Paper

The research paper should have a maximum of 10 pages, single-spaced, with 12-pt font. The page limit includes figures, but not references. Students may ask their advisor for advice in the preparation of this document. Students may also get assistance from MIT's Writing and Communication Center, http://writing.mit.edu/wcc. The following elements must be included:

Abstract - A concise summary of the motivation, research objectives, methods, and key results. A person unfamiliar with the topic should be able to understand the abstract.

Introduction – [≈ 2 pages] At least one paragraph should be written for a general audience, clearly enunciating why someone outside your field should care about this work. The introduction should also contain a detailed literature review that explains how your research is related to previous research and what your research will add to the larger body of research. Finally, the

introduction should clearly state the short- and long- terms goals of the work, connecting to a broad engineering or societal problem that motivates the work.

Methods – Describe and defend your methods, including your assessment of uncertainty. Include citations of previous applications of the method.

Results - Describe specific results, including a careful explanation of the uncertainty.

Discussion - Compare and contrast the results with other studies, including citations. Explain how you have addressed the technical questions and long-term applications mentioned in the methods and introduction.

The student distributes the research report to their committee **a minimum of one week** before the presentation. The student should inquire whether each committee member prefers a pdf or hard copy, and deliver the preferred format.

Review of a Relevant Publication

Your advisor, in consultation with the GE2 committee, will select a single journal publication in your field. It may be a seminal paper from years ago or a new paper. It should not be longer than 20 pages and cannot be too broad, e.g. no general reviews of the field. You should be prepared to informally discuss the paper (no slides), focusing on a set of 2 to 4 questions that will be provided by the committee when the paper is assigned. The questions may include some of the following, or they may be more specific to the paper. Please prepare for the paper review on your own.

What is the most important result and why is it significant?
What is the value of the paper to the broader field?
What are the limitations of the work and results presented?
What is the most significant uncertainty and how could it be reduced?
How do the results of this paper relate to your research?
Please show the full derivation of equation (5).
Are all of the conclusions justified by the results?
Are the boundary conditions realistic?
Explain in physical (chemical, biological) terms why the relationship shown in Figure 7 makes sense, or does not make sense.
How does this paper challenge the existing theory regarding _____ ?
Propose a new research question or hypothesis that expands on the work presented in this paper, i.e. where would you go next? Defend your choice.

Oral Presentation Meeting

The student should schedule the committee meeting for 2 hours. The Chair of the Committee, who will be sent specific instructions before the meeting, runs the meeting. The student will begin by informally presenting their response to the question(s) posed by the committee regarding the paper chosen for review (see *Review of a Relevant Publication* above). The student should not prepare slides for this response. Necessary visuals or equations can be sketched on the black board. Committee members may ask questions for clarification or to go into further depth. After twenty to thirty minutes, the committee chair will end this discussion and instruct the student to begin their research presentation. The student should plan a 30-minute presentation, but the actual presentation will take longer as faculty will interrupt with questions. The committee members are expected to have read the report and come prepared with questions. The committee members should push questions to the point at which the student says, “I don’t know”. The student should not be afraid of saying, “I don’t know”. It is at this point that the real scientific discourse begins, an exchange of ideas that provides a learning experience for the student. It is important to note that the research advisor is encouraged to ask questions, but he/she *should not answer questions*. This is a test of the student's understanding and

research ability, not a test of the advisor's research ideas. The GE oral presentation also serves as a practice for the student in preparation for their thesis proposal, which has a similar format.

Evaluation Committee for General Exam Part 2
The evaluation committee for Part 2 is comprised of three people, including the student's thesis advisor. The committee must have a minimum of two faculty or Senior Research Staff in CEE. In many cases this group will become the Doctoral Thesis Committee. The chair of the evaluation committee must be a faculty member or Senior Research Staff in CEE and cannot be the thesis advisor. The student invites the committee members and includes their names on the Part 2 Schedule Form. After the form is submitted, one additional CEE faculty member from outside the core area will be assigned. The role of the outside person is to promote active questioning, especially on a basic level. The goal is to test the student's ability to answer questions in a way that a non-expert will understand.

General Exam Part 2 Outcomes
After the exchange of questions and ideas has finished, or at 1hr 40 min, which ever comes sooner, the committee chair will ask the student to leave and wait nearby. The faculty advisor will be given a few minutes to add their perspective on the student's performance that day, on the student's broader research ability, and any specific requirements for the student. The committee chooses one of the following outcomes, which must be communicated with the student immediately following the meeting.

1) Pass with no additional requirements (may include minor changes to paper)
2) Re-take (may include additional requirements as noted below)
3) Fail with no option to retake (only if this is a second attempt)

Additional requirements could include any activity that the committee feels will improve on a perceived deficiency in core knowledge or research skill. Here are some examples:

Repeat a class as a listener to strengthen weakness in fundamental knowledge
Write a detailed review of a particular experimental method or paper
Take a public speaking course
Meet with writing center staff to go over research paper
Do a more complete literature search
Re-write a section of the research paper
Complete additional analyses on the data presented in the paper

The student is informed of the outcome directly after the meeting. In addition, the outcome is officially recorded with the General Exam Part 2 form [available at https://cee.mit.edu/resources/] that is sent to Graduate Academic Administrator (Kiley Clapper) at the Academic Programs Office (Room 1-290; kclapper@mit.edu) and provides a copy to the student.

Completion of any additional requirements will be monitored by the faculty advisor and communicated to the Graduate Academic Administrator (Kiley Clapper) when completed.

Doctoral Thesis Committee and Approval of Doctoral Research Proposal
After passing Part 1 and Part 2 of the General Exam (typically at end of AY2), the student forms a Doctoral Thesis Committee and **within one academic term** schedules a defense of Doctoral Research Proposal, i.e. typically by the end of Fall Term AY3. The Doctoral Thesis Committee consists of a minimum of three MIT faculty or Senior Research Staff, including a minimum of two of faculty or Senior Research Staff from CEE. The committee may have the same membership as the Part 2 Evaluation Committee. If appropriate, the student may invite members from outside MIT. The student invites one committee member to be the Chair. The Chair must be a faculty or Senior Research Staff in CEE and cannot be the student's advisor. Once the Thesis Committee is formed,

the student prepares a Research Proposal and schedules a date to present the proposal orally to the Doctoral Thesis Committee. The proposed research must be in the field defined by the student's Core area. The objectives of the research should be prepared with guidance from the advisor. Because most doctoral research is funded by projects developed by the advisor, it may need to meet specific benchmarks. The proposed work must accommodate these constraints. The necessary components are given below. The oral presentation is 45 minutes, followed by 45 minutes of questions.

Required Components in the Research Thesis Proposal

The thesis proposal should be a **maximum of 15-pages of single-spaced, 12-point font**. The document should be written by the student. Faculty advisors may review one draft and provide feedback. Figures are included in the page count, but references are not. The following sections must be included.

Abstract - A ½ to 1-page summary of the topic, the objectives/hypotheses to be achieved/tested, and the methods. The abstract should be written for a general scientific audience, i.e. a person unfamiliar with the topic should understand what is being proposed and why it is important.

Introduction - The goal of this section is to motivate the research. Convince the reader why the project is important. The following progression is recommended. Introduce the topic and explain the broad engineering or societal problem that motivates the work. The introduction should contain a detailed literature review that explains how your research is related to previous research and what your research will add to the larger body of research. Identify knowledge gaps and connect proposed research to the state of understanding in the literature.

Objectives and Hypotheses - Clearly state the research question to be answered and/or hypotheses to be tested and support it by explaining the logic that led to it. Preliminary data may be used as support.

Proposed Research - Describe the methods in detail, explaining how each research question will be answered and/or how each hypothesis will be tested. Include a time-line to demonstrate that the proposed work is feasible within the duration of a PhD degree. Describe specific expected results, and clearly explain how these results 1) address the original research question and 2) connect to the broad engineering or societal problem that motivated the work.

Defense of Thesis Proposal to Doctoral Thesis Committee

At least 10 days prior to the proposal defense, the student e-mails the written proposal to the committee members with a final schedule of when and where the presentation will take place. After submitting the proposal to the committee, the candidate should neither solicit nor expect to receive feedback from any of the committee members, including the advisor, prior to the presentation. On the day of the proposal defense, the student brings a copy of the form, *Record of Approval of Doctoral Thesis Research*, which is available at https://cee.mit.edu/resources/.

During and after the oral presentation, the Committee members ask questions related to the presentation, to the written proposal, and to the general topic of the proposed research. The Committee should raise questions about the motivation, novelty, potential impact, and feasibility. The research advisor is encouraged to ask questions, but should not answer questions. This is a test of the student's understanding and research ability. It is not a test of the advisor.

At the end of the question period, the student is asked to leave the room while the Committee, including the advisor, evaluates the candidate's performance in these areas: quality of written presentation, quality of oral presentation, technical quality and novelty of proposed research, feasibility within duration of degree, and ability to respond to questions. The possible outcomes are:

1) Approved

2) Modification required as specified by the committee. Committee must provide detailed feedback and timeline for re-submission of proposal.

The Committee Chair records the outcome and any specific requirements for alteration on the form Record of Approval of Doctoral Thesis Research.

The Committee Chair forwards the completed form to the Graduate Academic Administrator (Kiley Clapper) at the Academic Programs Office (Room 1-290; kclapper@mit.edu) and provides a copy to the student.

After the approval of the thesis proposal, the student schedules regular meetings with the doctoral committee to demonstrate progress and receive feedback. Two meetings per year are recommended, and a minimum of one meeting per year is required. The committee chair may require additional meetings in response to significant problems or changes in research direction. To each meeting, the student should bring a copy of the form, *Record of Doctoral Thesis Committee Meeting*, which is available at https://cee.mit.edu/resources/. After the meeting, the student should bring the original, signed form to the CEE Academic Programs Office (1-290) and keep a copy of the form for their own records. The minimum requirement of one meeting per year is assessed at each CEE Grades Meeting (January and May) based on the forms on file at the Academic Programs Office.

Approaching the Defense of a Doctoral Thesis – Green Light Meeting
One or two months before the anticipated doctoral defense date, the student must convene a final committee meeting, called the Green Light meeting, usually around 90 minutes in length. The student presents an outline of the full thesis, highlighting results from each chapter, indicating papers published, in review or in prep, and lays out a timeline for completion. They may then spend time discussing new results (since last committee meeting) and the plan for uncompleted work prior to the defense. The committee will provide their opinion of what is the weakest component of the work and what they foresee as possible stumbling blocks for completion. The committee will then decide whether to approve the outline, which allows the student to schedule the thesis defense. If the committee approves the work, they will sign the *Green Light Thesis Committee Meeting* form [available at https://cee.mit.edu/resources/], which is sent to the Academic Administrator. Once this form has been received, the student can schedule the doctoral defense.

Checklist for Doctoral Thesis

MIT has specific guidelines for writing and formatting your thesis. Please follow them closely.

https://libraries.mit.edu/archives/thesis-specs/

MIT has three degree-granting cycles per year: February, June and September. Several months prior to the defense date, the student should register to be on the appropriate degree list, by going to student.mit.edu; selecting “online degree application”, and following the instructions. Once this registration is complete, the Academic Administrator will send the student a email outlining the steps to complete the degree and organize the thesis defense within the timeline required for the selected degree-granting cycle.

Preparing for and Scheduling your Defense
The doctoral defense must occur a **minimum two weeks** prior to the department’s thesis submission deadline. The date changes each year, so the student must check with the Academic Administrator to find out the date for a particular degree list. The first draft of the thesis must be sent to the committee two weeks before the scheduled defense date. At least 10 days prior to the defense date the student should communicate the date, time and location to the Academic Administrator and fill out the abstract template, which is available from the Academic Administrator.

The student should also send an pdf copy of the thesis draft to be shared with the CEE faculty prior to the defense.

Planning the Public Presentation.
The thesis defense has two components, a public presentation and a closed session with the thesis committee. The entire thesis committee must attend the defense, either in person or remotely via web-conferencing. The public presentation should be 40 minutes long and have a ten minute questions period at the end. The student should encourage lab- and classmates to attend the public presentation. The public presentation must accommodate a broad audience, with an Introduction that is understandable to a general audience (including family members), but with other sections demonstrating technical depth that may only be accessible to people within the field. After the public presentation is completed, the audience is asked to leave, so that the closed session can begin. The closed session will range from 30 minutes to 1.5 hours long. A Record of Successful Defense form [available at https://cee.mit.edu/resources/] should be submitted by the student to the Academic Program Office following the defense.

To book a room, the student should work with the administrative assistants in Pierce or Parsons. We suggest a reservation of 3 hours – with a start time 15 to 20 minutes before the scheduled defense start time and an end time 15 to 20 minutes past the projected meeting end.

Publicizing the Defense Date
The student should make flyers publicizing the defense. The flyer should include the student's name, the title and abstract of the thesis, the thesis supervisor's name, and the date, time and location of the defense. We strongly encourage the inclusion of interesting images. The abstract should be no more than 350 words. Once the flyer is completed, the student should send a pdf to the Academic Administrator, who will distribute the announcement electronically to the CEE community. In addition, the student should print 11 copies and post 5 in Parsons, using the public bulletin space in the hallways and kitchen, and 5 in Pierce, using the public bulletin space in the hallways and lounge, and drop one off in 1-290.

Submitting the Thesis to the Academic Programs Office
The committee will usually request edits to the written document. Once the edits have been completed, the student submits two copies of the thesis printed on acid-neutral or archival bond paper and signed by the advisor(s). The final copies must be submitted by 5 pm on the department's deadline, which is provided by the academic administrator. The academic administrator will retrieve the signature of the Chair of the Graduate Education Committee, so the student need not contact him/her directly. The copies must be unbound but secured between heavy cardboard covers with a binder clip. The front cardboard cover of each thesis copy should feature a photocopy of the top half of the thesis signature page (from the copyright up), which can be simply taped or glued on.

Important Notes on Thesis Completion

- All thesis content must be present in draft form prior to the defense. When a PhD document is sent to the department to circulate two weeks in advance of the defense, the APO will verify that all the chapters listed in the Table of Contents are present in the document. If not, the APO will follow up with student and advisor.
- When the final thesis is submitted to the department:
    - the APO will issue a receipt (with carbon copy kept in the department), signed by both the student and the recipient
    - the final thesis will be secured until it is submitted to the MIT libraries

- No substantive changes can be made to the final thesis after it is submitted to the department. Only minor modification (e.g. replacing a single page with an incorrect figure) will be considered prior to submitting the thesis it the MIT library, and must be approved by the Graduate Officer.
- The student's graduate appointment will be terminated on the day of their thesis submission.
    - Prorated tuition and fees are available to graduate students who complete their thesis early. The APO will notify the Registrar that the student is leaving early, and the Registrar will adjust the tuition or fee amount.

Congratulations!!

We look forward to the hooding ceremony and graduation to celebrate. Please let us know what is next by filling out the Graduate Student Exit Form: http://cee.mit.edu/graduate/exitform

CEE General Part 1 Three-Subject Core lists

The 3-Subject Core reflects core knowledge in the student's chosen field, which is tested in Part 1 of the General Exam. The subjects are selected from an approved list within one of the following sub-groups.

All three subjects must come from the same core list.

Atmospheric Physics and Chemistry [choose three, at least two from CEE]
1.84 Atmospheric Chemistry
1.841 Atmospheric Composition in the Changing Earth System
1.83 Environmental Organic Chemistry
12.815 Atm. Radiation & Convection
EPS236 Environmental Modeling

Engineering Physics for Urban Systems [choose three, at least two from CEE]
1.204 Computer Modeling: From Human Mobility to Transportation Networks
1.631 Fluid Dynamics and Disease
1.57 Mechanic of Materials: An Energy Approach
4.433 Modeling Urban Energy Flows for Sustainable Cities and Neighborhoods
8.333 Statistical Mechanics I

Environmental Chemistry [choose three, at least two from CEE]
1.76 Aquatic Chemistry
1.78 Introduction to Soil Science
1.83 Environmental Organic Chemistry
1.84 Atmospheric Chemistry
1.841 Atmospheric Composition in the Changing Earth System
1.727 Surface Water Ecosystems: Biogeochemistry and Chemical Transport

Environmental Fluid Mechanics [choose three, at least two from CEE]
2.25 Fluid Mechanics
1.63 Advanced Fluid Mechanics or 1.686 Nonlinear Dynamics and Turbulence
1.69 Introduction to Coastal Engineering or 1.685 Nonlinear Dynamics and Waves or 1.138 Wave Propagation
1.72 Groundwater Hydrology
1.61 Transport Processes in the Environment

Environmental Microbiology
1.87 Microbial Genetics and Evolution
1.89 Environmental Microbiology
and one of the following:
- 1.871 Computational Ecology
- 6.874 Computational Systems Biology
- **7.492[J] Methods and Problems in Microbiology**

Ecology and Evolution [choose three, at least two from CEE]
1.871 Computational Ecology
1.873 Ecological Dynamics and Modeling
1.TBD Resilience of Living Systems to Environmental Change
8.591 Systems Biology
12.849 Mechanisms and Models of the Global Carbon Cycle or 12.586 Modeling Environmental Complexity
HST.508 Evolutionary and Quantitative Genomics

Hydrology [choose three]
1.72 Groundwater Hydrology
1.714 Surface Hydrology
1.731 Water Resource Systems
1.723 Computational Methods for Flow in Porous Media

CEE General Part 1 Three-Subject Core lists

Geotechnics / Geomechanics
1.361 Advanced Soil Mechanics
and two of the following
1.364 Advanced Geotechnical Engineering
1.38 Engineering Geology
1.72 Groundwater Hydrology

Materials [choose three, at least two from CEE]
1.545 Atomistic Modeling and Simulation of Materials and Structures
1.570 Micromechanics and Durability of Solids
1.573 Structural Mechanics
1.535 Mechanics of Materials or 3.22 Mechanical Behavior of Materials
3.36 Cellular Solids: Structure, Properties, Application

Structures Mechanics / Engineering [choose three, at least two from CEE]
1.541 Mechanics and Design of Concrete Structures
1.573 Structural Mechanics
1.581 Structural Dynamics and Vibrations
2.093 Finite Element Analysis of Solids and Fluids I
3.22 Mechanical Behavior of Materials

Systems Engineering
Select one course each from two different methods
Probability and Statistics: 6.436, 1.203, 6.431
Optimization: 15.093, 15.081
Machine Learning: 6.883 or 15.077 (or 6.867 with permission of research advisor)
Select one of the following CEE domain subjects
1.208 Resilient Networks
1.202 Demand Modeling
1.260 Logistics Systems
1.271 Supply Chain
1.731 Water Systems
1.001 Eng Computation and Data Science

Computational Science and Engineering [CSE/CEE]
for students enrolled in the CSE PhD program in the Center for Computational Engineering (CCE) and residing in CEE; or for students entering the CEE PhD program after completing the CSE SM program from the CCE.

Systems Engineering
Select one course each from two different methods
Probability and Statistics: 6.436, 1.203, 6.431
Optimization: 15.093, 15.081
Machine Learning: 6.883 or 15.077 (or 6.867 with permission of research advisor)
Select one of the following CEE domain subjects
1.208 Resilient Networks
1.202 Demand Modeling
1.260 Logistics Systems
1.271 Supply Chain
1.731 Water Systems
1.001 Eng Computation and Data Science

Software Systems in CSE/CEE [choose three]
1.125 Arch & Eng. Software Sys - CSE approved Subject
1.001 Engineering Computation and Data Science
6.255 Optimization Methods
6.337J Introduction to Numerical Methods - CSE approved Subject

Flow Models in CSE/CEE [choose three]
1.204 Computer Modeling: From Human Mobility to Transportation Networks
1.208 Resilient Infrastructure Networks
1.723 Computational Methods for Flow in Porous Media
2.097 Numerical Methods for Partial Differential Equations – CSE approved Subject
2.096 Intro to Numerical Simulation – CSE approved Subject

Computational Science for Resource Engineering CSE/CEE [choose three]
1.723 Computational Methods for Flow in Porous Media
1.545 Atomistic Modeling and Simulation of Materials and Structures.
1.125 Architecting and Engineering Software Systems - CSE approved Subject
6.337 Introduction to Numerical Methods - CSE approved Subject
2.096 Introduction to Numerical Simulation – CSE approved Subject