

*Department of Chemical Engineering
University of Virginia*

GRADUATE PROGRAMS HANDBOOK

Oct 2021

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HOW TO SUCCEED IN YOUR GRADUATE EDUCATION

Graduate studies in chemical engineering leading to master's and doctoral degrees offer students an opportunity to mature to an advanced stage in their profession while contributing to the advancement of science and technology. The purpose of this note is to communicate the faculty's perspectives on how you might do this in the most effective and satisfying manner.

Research

To be able to make useful and recognizable research advances students are expected to carry out the following independent activities:

- Reading and study. Regular reading of literature related to your research project is expected. This involves searches of journal databases and regular perusal of current issues of major journals in chemical engineering, your research area, and science and technology. You can work with your advisor to determine an appropriate list for your area of research. Looking in literature of related areas for new connections is also very valuable. ChE has provided a CHE Research Tools tab on UVA Collab for your use as well.
- Commitment. Graduate research requires your full-time dedication and year-round effort. A typical workweek will require 50-60 hours in the lab. To facilitate information exchange with others and for safety reasons, the bulk of those hours should include the period from 9 am – 5 pm Monday through Friday as much as possible. Graduate students are expected to be involved with their projects between semesters and during spring break. One week of vacation around Christmas holidays and one week during the summer is reasonable. Any periods of vacation or leave should be discussed with your advisor in advance.
- Taking ownership. Ph.D. research involves students taking “ownership” of their project. By the time students’ finish, they should have become experts in their area. They will not think they work “for their advisor,” but that they are working for THEMSELVES and their PROFESSION by being fully self-motivated to answer the questions they are working on. Another aspect of becoming an independent researcher is taking initiative in seeking advice from and discussing ideas and solving problems with fellow graduate students and faculty not only within the department, but also outside the department and University.
- Documentation. Research requires documentation of the work that is done and it is easy to forget or omit details that can prove vital to discovery or progress. Contemporaneous note-taking helps in communication, remembrance and organization. It is imperative to keep a laboratory notebook. All patents require careful documentation of the work performed, which must be signed and dated.
- Publications are the indicators of success and how a field progresses. Writing articles is an essential part of the graduate experience. As a result, there are expectations that a number of manuscripts will arise from a thesis or dissertation.
- Oral presentations are another way that research results are transmitted and are an especially good process for students to experience. They also represent an excellent opportunity to gain exposure in the field and receive feedback to one's research. Thus, all students, especially doctoral students, should present research results at national and

international meetings. Regional or local meetings are also valuable. Students should take the initiative to seek out and propose the meetings at which they wish to talk.

Coursework/Seminars

- Graduate classes are intended to reinforce your fundamental understanding of chemical engineering and to help you become independent thinkers. As a result, the assignments and course structure are different from undergraduate classes because less direction is given in the subject; homework, examinations and projects are broader and more open-ended; and teachers expect student initiative in seeking the most important aspects. Graduate students are expected to treat their classes and class work as times of questioning, diligence and thoughtful pursuit of knowledge. In addition, students are encouraged to take courses outside of their department to broaden their knowledge base.
- Departmental seminars are intended to help students broaden their educational experience beyond the narrow focus of their thesis research. Therefore, regular attendance at departmental seminars is expected. Students are encouraged to ask questions of seminar speakers. It is also important to engage your fellow students in thoughtful discussion of their research. Group meetings and thesis defenses are forums in which this kind of discussion is encouraged.
- Advanced education includes helping others to learn. It is also recognized that through the process of teaching others, one's own understanding of the course material is strengthened. Thus, Ph.D. students are required to serve as a graduate teaching assistant for at least one semester.

Service

- Professional status requires service attitudes and action. Graduate students are expected to contribute to the processes that make their educational environment function. Thus, while there are a variety of ways this could be done, ranging from coordinating a seminar to serving on the graduate student advisory group to organizing an intramural recreation team, all students should volunteer to donate time and effort to fill needs in the university or the community. Students should also become members in professional associations related to their field, such as the American Institute of Chemical Engineers and the American Chemical Society.

Honor Code

As is true for any University of Virginia student, Chemical Engineering graduate students are expected to adhere to the University of Virginia Honor Code.

OVERVIEW of GRADUATE PROGRAMS

The Department of Chemical Engineering offers graduate programs leading to these degrees:

Doctor of Philosophy (Ph.D.)
Master of Engineering (M.E.) *
Master of Science (M.S.)**

*With the exception of the M.E. degree program offered using a distance-learning format (VEO program) all graduate study in the Department requires full-time attendance.

**New Masters students are typically only admitted to the M.E. program. In cases where a Chemical Engineering faculty member is willing to serve as thesis advisor, it may be possible for M.E. students to transition to a thesis-based M.S. degree.

Doctor of Philosophy

The major elements of the doctoral program are:

- (1) Research Examination and Admission to Doctoral Study
- (2) Dissertation Proposal and Admission to Candidacy
- (3) Teaching assistant experience
- (4) Research
- (5) Dissertation and Final Defense

It is expected that the Ph.D. program will be completed in five years beyond the B.S. degree or three years beyond the Master's degree.

Master of Engineering and Master of Science

The Master of Engineering (M.E) degree can be completed through coursework alone. Students will take five core graduate courses dealing with the fundamental aspects of chemical engineering. These courses comprise half (15 credits) of the minimum 30-credit requirement for the Master's degree. The M.E. requires three to five elective graduate courses, depending on whether a student enrolls in a research credit course (for a maximum of 6 credits).

In cases where a Chemical Engineering faculty member is willing to serve as thesis advisor, it may also be possible for M.E. students to transition to the thesis-based Master of Science (M.S.) degree. The Master of Science degree requires an independent research effort culminating in a written thesis that must be defended before an examining committee. The M.S. degree requires three elective graduate courses, in addition to the five core graduate courses.

DOCTORAL PROGRAM

GENERAL

Possessors of the doctorate are understood to have mastered in depth a segment of human knowledge and to have contributed significantly to that body of knowledge. The doctoral program includes advanced course work but emphasizes the conduct of original research.

In assessing prospective candidates for the doctorate, the faculty will consider the student's overall academic record, prior performance in research, and the evaluations of appropriate references. Formal requirements for admission to doctoral candidacy include, in addition to advanced course work, satisfactory performance on the Research Examination, and the preparation of an acceptable dissertation proposal. In all of these, the student will be expected to demonstrate familiarity with the fundamental concepts and techniques of chemical engineering and, above all, to be able to apply these concepts and techniques to original and ill-defined situations.

PROGRAM STRUCTURE AND DURATION

The major elements of the doctoral program, described in detail below, are:

- (1) Research Examination and Admission to Doctoral Study
- (2) Dissertation Proposal and Admission to Candidacy
- (3) Teaching assistant experience
- (4) Research
- (5) Dissertation and final examination

The Ph.D. candidacy procedure culminates with Admission to Candidacy and consists of two parts: (1) the oral and written Research Examination and Admission to Doctoral Study; and (2) the Dissertation Proposal and Admission to Candidacy. Students apply to undertake the Research Exam.

Residency requirements for the degree are set by SEAS.

FINANCIAL SUPPORT AND SATISFACTORY PROGRESS

As detailed in their offer letter of admission, students admitted to the University of Virginia Department of Chemical Engineering Ph.D. program receive a stipend and all tuition and fees will be paid by the Department as long as the student maintains satisfactory progress. The University also pays for health insurance for all full time graduate students who choose to accept the University's health plan.

Satisfactory progress in the University of Virginia Chemical Engineering Ph.D. program requires:

1. A graduate student to successfully find a suitable research advisor approved by the Department of Chemical Engineering in their first academic year.
2. Passing the Ph.D. qualifying exam.
3. A grade of "satisfactory" assigned for research credit hours.
4. A cumulative GPA of 3.0*
5. Since students are expected to complete the Ph.D. program in 5 years beyond the B.S. degree, financial aid is not guaranteed beyond 5 years after matriculation at UVA. Continued funding past 5 years is at the discretion of the advisor and approval of the department. Four years beyond matriculation will be the

expectation for students entering with a Masters degree in chemical engineering.

RESEARCH EXAMINATION AND ADMISSION TO DOCTORAL STUDY

All Ph.D. students must pass a Ph.D. research examination in the beginning of their second year. After passing the Ph.D. research examination, the student may elect to complete an M.S. degree, but is not required to do so (unless specifically deemed necessary by the faculty or research advisor.) The Research Examination is to be taken within one month after completing the first summer of research. The student must describe, in both written and oral forms, his/her research progress to that time as well as plans for further work. Although the motivation, background and technical originality of the research are important components, the overall goal is to assess the student's aptitude for research. The written document and oral presentation will be limited in length. Following the oral presentation to the faculty, exam committee, faculty serving on the committee will ask the student questions on their research, which will include a focus on connections to core chemical engineering principles, e.g., Thermodynamics, Transport, Fluid Dynamics, Heat Transfer, etc. The outcomes of this exam are pass, pass with conditions, or fail. Students failing the exam taken in September will have an opportunity to retake the exam at the end of the fall semester.

Students must indicate in writing their intention to take the Research Exam when it is announced.

Admission to Doctoral Study is a formal action of the departmental faculty. It indicates acceptance of the student into the ultimate research phase of the doctoral program.

In order to be admitted to doctoral study the student must have:

- (1) completed a program of advanced course work, here or elsewhere, equivalent to the departmental course requirements for the Master's degree
- (2) passed the Research Examinations
- (3) demonstrated, to the faculty's satisfaction, a capability for independent research of the quality expected for the doctorate.

Although there are no specific elective departmental course requirements for the doctoral degree, students should work closely with their advisors on how to structure their electives. Their courses should ensure both depth in the specific research area and breadth in chemical engineering and related sciences.

DISSERTATION PROPOSAL AND ADMISSION TO CANDIDACY

Doctoral students are required to prepare a written Dissertation Proposal. The proposal should indicate the purpose and objectives of the work to be undertaken, the current state of the art with bibliography, and the strategy to be followed and techniques to be employed in the research. Preliminary data, calculations, and/or theoretical developments should be included in support of the proposed work. The proposal document should also include a brief (not more than one page) outline summarizing career planning activities prior to the proposal and the career planning trajectory moving forward, as well as a current c.v. The proposal will be presented orally and discussed publicly. Parts of the proposal can be closed in cases where IP or contractual obligations require it.

For the purposes of the dissertation proposal, the faculty advisory committee must include a minimum of 3 SEAS faculty, one additional UVA faculty member from outside the student's home department, and a minimum of 4 total members. The outside member must be UVA faculty.

The purposes of the dissertation proposal are:

- (1) to determine if the student's knowledge of the area chosen for research and the pertinent literature is adequate
- (2) to determine whether the proposed work, if completed, would provide the basis for an acceptable dissertation
- (1) to advise the student on general approaches and specific techniques that may be helpful in the proposed research.

If, in the judgement of the advisory committee, the student's proposal is not satisfactory, the student may be required to submit a revised proposal for further discussion with the Advisory committee.

The dissertation proposal should be completed within two years of completing the research exam (doctoral qualifying exam). Upon successful defense of the Dissertation Proposal, the student will be admitted to candidacy for the doctorate.

PhD students are encouraged to consult with their thesis committee not later than six months prior to the thesis defense to briefly discuss progress since the thesis proposal and plans for work to complete prior to the defense.

TEACHING EXPERIENCE

To contribute to the educational and professional development, each doctoral student must serve as a graduate teaching assistant for a minimum of one semester. A grade of "S" is required for at least one semester of teaching assistantship in order to graduate.

RESEARCH

Research begins as soon as the student has chosen a research advisor. Research remains a primary focus of the student throughout enrollment in the graduate program

DISSERTATION AND FINAL EXAMINATION

Finally, the candidate must present and publicly defend a dissertation based on his/her independent original research to a committee that includes the Doctoral Advisory Committee and one additional member for a total of 5 faculty members. Dissertations and a current c.v. should be submitted to committee members two weeks prior to the defense date.

PLEASE NOTE THAT CHE REQUIRES THAT THE BIBLIOGRAPHY INCLUDE TITLES OF JOURNAL ARTICLES

SEAS forms may be obtained from the current graduate student section of the SEAS website.

MASTER'S PROGRAMS

The Department of Chemical Engineering offers graduate programs leading to Master of Engineering (M.E) and Master of Science (M.S.) degrees. Basic ("core") course requirements (see below) are identical. The VEO program follows the same basic requirements as the traditional M.E. program with two exceptions. All core courses must be taken at UVA and there is not a research credit option. The M.S. degree requires an independent research effort culminating in a written thesis, while the M.E. degree can be completed with only coursework.

Purposes

A master's degree, either M.E. or M.S., fulfills several roles in the overall scheme of engineering education. Its first -- and surely its most important -- function is to enable students to solidify and enhance the knowledge and skills developed in the ever more demanding undergraduate curriculum.

Another purpose is to provide students with an opportunity to carry out significant research or project work independently, with the advice and guidance of a faculty member.

Finally, a master's degree program permits students to undertake some specialization. Virginia's graduate chemical engineering program offers such opportunities in a number of fundamental areas of chemical engineering (fluid mechanics, mass transfer, thermodynamics, reaction engineering, molecular simulation) and in various aspects of applied chemistry and chemical technology, biotechnology, biochemical engineering, catalysis, electrochemistry, environmental engineering, materials, rheology and surface science.

Program duration

The master's program is ordinarily begun in the fall semester, with the required course work being taken during the fall and spring semesters. If a student transfer to M.S., thesis research or project work, begun during the academic year, is then carried out on a full-time basis during the following summer and academic year.

Students must complete all requirements for the M.S. degree within five (5) years after admission to the graduate program and must complete all the requirements for the M.E. degree within seven (7) years after admission.

Degree requirements

A minimum of thirty (30) credits -- or "semester hours" -- of graduate level courses are required for a master's degree, either M.E. or M.S., in chemical engineering. Degree candidates must complete an approved plan of studies incorporating the following:

- (2) For the M.E. degree:
 - a) A minimum of 30 credits of graduate course work including the five core chemical engineering courses. (VEO program requires all core course are taken at UVA)
 - b) Of the 30 required credits, a maximum of 6 may come through enrollment in CHE 7995.

- (3) For the M.S. degree:
 - a) A minimum of 24 credits of graduate course work including the five

- chemical engineering core courses.
- b) A minimum of 6 credit hours of research carried out under thesis course, ChE 8998.
 - c) Presentation of an acceptable thesis based on research conducted under ChE 8998.

All candidates for master's degrees should regularly attend the graduate seminar (ChE 7796).

Transfer credit may be approved for inclusion in the plan of studies for the master's degree. Only graduate courses completed at another institution of recognized standing will be considered. Candidates for the M.S. degree may include a maximum of six (6) semester hours of transfer credit; candidates for the M.E. may include a maximum of twelve (12). Application for transfer credit is made on the Request Approval of Transfer Credits form which can be found in the current graduate students section of the SEAS website.

Chemical Engineering Core Courses

The five core graduate chemical engineering courses are:

- ChE 6625 - Transport processes
- ChE 6665 - Techniques for chemical engineering analysis & design
- ChE 6615 - Advanced thermodynamics
- ChE 6618 - Chemical reaction engineering
- ChE 6630 - Mass transfer.

Persons who have completed equivalent work elsewhere before entering the program will not be required to take the corresponding course at UVa.

Advisors

Newly enrolled graduate students will be advised by the Graduate Program Coordinator. Soon after the start of the fall semester, new graduate students will receive a list of current research topics being offered and will select a topic for their thesis dissertation. The faculty member with whom the student will work then becomes his or her advisor.

Plan of study

Each candidate for the master's degree must submit a Plan of Study (available in the department office), approved by the advisor and the department. It is most appropriate to prepare this during pre-enrollment at end of the first semester of graduate study.

The recommended course load for master's degree candidates is four 3-credit graduate courses per semester. Students who wish to carry more than four courses in a semester must secure the recommendation of their advisor and the approval of the departmental faculty.

Application for degree

Candidates for the master's degree must make formal application on the Application for Graduate Degree form (available from the current graduate students section of the SEAS website) as well as through SIS. Deadlines for application are:

October 1 for January graduation
February 1 for May graduation

June 1 for August graduation

M.S. thesis and examination

After the student's MS thesis has been approved by his/her advisor, an examining committee will be appointed. This committee consists of at least three UVA faculty members; two faculty members must be from Chemical Engineering. The Final Examination Committee form (can be found in the current graduate students section of the SEAS website) is used to request appointment of the examining committee. Copies of the thesis should be given to the committee members **at least one week** before the date of examination; however, individual committee members may expect the thesis with more advanced time so be sure to check with your specific committee members.

After the thesis has been approved by the examining committee, the Report on Final Examination will be sent to the Dean from the department. The student is responsible for submitting the thesis electronically through LIBRA.

PLEASE NOTE THAT CHE REQUIRES THAT THE BIBLIOGRAPHY INCLUDE TITLES OF JOURNAL ARTICLES

Quality of work

Graduate students are expected to maintain high standards of quality in their graduate courses and in their thesis research or project work. Any graduate student whose grade-point average (GPA) in graduate level courses falls below B (GPA = 3.0) will be placed on probation. Such students will be subject to dismissal if the cumulative GPA is not raised to 3.0 within one semester.

Worksheet

The following is provided as a personal worksheet to plan/record your progress

Graduate Research Advisor _____

MS Plan of Study _____

Core Courses: ChE 6615 _____
ChE 6618 _____
ChE 6625 _____
ChE 6630 _____
ChE 6665 _____

Other Courses: _____
(usually 6000 _____
or above) _____

Research Credits: _____

Research Exam _____

(Aug./Sept 2nd year)

If chosen or required:

M.S. Final Examination Committee _____

Defense and Electronic Submission of M.S. Thesis to LIBRA _____

In the semester immediately following receipt passing the Research Exam or receipt of M.S./Non-Terminal M.E.:

Doctoral Advisory Committee _____

Doctoral Plan of Study _____

Courses & Research Credits: _____

Ph.D. Dissertation Proposal Presentation _____

Ph.D. Final Examination Committee _____

Ph.D. Dissertation Defense _____

Research Student Laboratory Check-out Form _____

Electronic Submission of Dissertation to LIBRA _____

Research Student Laboratory Check-out Form

Name: _____

This form is to be turned in to the ChE Graduate Program Coordinator upon completion of laboratory work but no later than three weeks prior to graduation by any BS, terminal ME, terminal MS, or PhD student who has conducted research in the ChE department. It is to be signed by the degree candidate and approved by his/her research advisor plus a lab representative (senior grad student or research associate appointed by the advisor who will be remaining in the lab). A degree will not be approved until this signed form has been filed.

1. All laboratory wastes associated with my project have been picked up by the Office of Environmental Health and Safety.
2. All unused chemicals have been assigned to another person in the laboratory, placed in Chemical Engineering common stores, or have been sent to the Office of Environmental Health and Safety.
3. All samples, apparatuses, laboratory notebooks, etc. have been stored in a manor acceptable to the research advisor.
4. My laboratory work area has been cleaned to the satisfaction of my research advisor and designated laboratory representative.

Degree Candidate Signature

Date

Approved:

Research Advisor

Date

Laboratory Representative

Date

U.Va. SEAS Enrolled Graduate Student Forms

Check the current graduate students section of the SEAS website for links to specific forms.

Ph.D.: Request appointment of your advisory committee.	Doctoral Advisory Committee (may be re-submitted if changed)
Ph.D.: Submit a report of your PhD (qualifying, preliminary, comprehensive) examination. You MUST also submit the program-specific qualifying exam assessment form (below)	PhD Examination Report and Program Specific Qualifying Exam Report
Ph.D.: Submit documentation of dissertation proposal, to be completed at the Proposal Examination. (replaces form G108) You MUST also submit the Engineering Dissertation Proposal Assessment form.	Dissertation Proposal and Engineering Dissertation Proposal Assessment
MS and Ph.D.: Request appointment of your final examination (defense) committee	Final Examination Committee
MS and Ph.D.: Submit a report of Final Examination, to be completed at exam. You MUST also submit a Thesis and Dissertation Assessment form and (Ph.D. only) a certificate of completion of the on-line Survey of Earned Doctorates	Report on Final Examination and Thesis and Dissertation Assessment Survey of Earned Doctorates
MS and Ph.D.: Official Cover and Approval pages which include the Dean's signature, to be completed at the final exam or after required corrections are complete. No faculty/committee signatures are needed for these pages which become the first two pages of the thesis/dissertation.	Thesis/Dissertation Cover and Approval Pages
ALL Degrees: Request change, exception or waiver to SEAS academic requirements.	Request Requirement Change, Exception or Waiver
MS/ME: Request approval of transfer credits/courses—will appear on U.Va. transcript (limit 6 in MS/12 in ME/ 15 in CGEP). Must be processed at least 2 weeks prior to graduation (including receipt of official transcript with final grade).	Request Approval of Transfer Credits
ALL Degrees: Request change of program/department or degree	Request Program Plan Change
Students should use this form to request a change of enrollment limit/status in order to switch from or to full/part-time (12 credits is full-time, less than 12 is part-time).	Change of Enrollment Limit/Status
MS and Ph.D.: Request use of SEAS graduate level (\Rightarrow 5000) courses taken while a UVA undergraduate student. Courses must have NOT been used for the undergraduate degree.	SEAS Graduate Course Approval
Students should use this form only to make schedule changes that cannot be made by using SIS.	UREG's Online Course Action Form

Outcome Assessment Forms

- [Engineering Analysis Assessment](#)
- [Engineering Design Assessment](#)
- [Engineering Dissertation Proposal Assessment](#)
- [Engineering Oral Communication Assessment](#)
- [Engineering Plan of Study Assessment](#)
- [Engineering Technical Writing Assessment](#)
- [Engineering Thesis & Dissertation Assessment](#)

Program-specific Qualifying Exam Forms

- [Chemical Engineering](#)