# THE INSTITUTE FOR A SUSTAINABLE ENVIRONMENT
# GRADUATE PROGRAMS
# PROCEDURES AND GUIDELINES



NOTE: All forms for M.S. and Ph.D. Students can be found at:
www.clarkson.edu/current_students/forms.html

## I. INTRODUCTION

The environment is composed of complex, interacting, biological, chemical, physical and social systems. To adequately understand the functioning of this complex system and to learn to integrate environmental factors into a decision-making process, it is essential that these systems be studied in an interdisciplinary framework. Thus, the Environmental Science and Engineering degree program spans both science and engineering and includes courses that investigate the uses of these disciplines in a broader context will help develop students who can analyze environmental impacts and use this information in all aspects of the engineering process. The Environmental Politics and Governance degree program examines the socio-economic and political basis for mechanisms as diverse as the allocation of federal funding of environmentally-related research, the development of science-based environmental policy, and taking into account the actions and interests of private sector firms and non-governmental organizations in the environmental arena.

This Handbook is intended to assist faculty members and graduate students with operating procedures, policies, and degree requirements for the graduate programs within the Institute for a Sustainable Environment, including:

- Master of Science in Environmental Science and Engineering (MS ESE)
- Master of Science in Environmental Policy and Governance (MS EPG)
- Doctor of Philosophy in Environmental Science and Engineering (PhD ESE)

## II. ADMINISTRATIVE ARRANGEMENTS

Responsibility for administering the graduate program is shared by the Graduate School (which sets University requirements) and the Clarkson Institute for a Sustainable Environment (which sets specific degree requirements). The requirements set by the Institute must be compatible with those of the Graduate School.

University requirements are available in the University Catalog. The most important are reproduced herein, but the ultimate authority remains with the Catalog.

The program is housed in the Clarkson Institute for a Sustainable Environment. The Institute Director or his or her delegate will oversee the program operation, appoint an admissions committee, and approve both the programs of study and the graduate committee membership for each student in the program. Also, a committee will be appointed by the Institute Director to periodically evaluate the program structure and operating practices.

## III. GRADUATE COMMITTEE

The ISE Graduate Committee is comprised of five full-time faculty members appointed by the Institute Director, and is responsible for the administration of graduate activities. Its primary duties are to review and evaluate all graduate applications, to facilitate communication with the Graduate School, to advise faculty on graduate matters, and to ensure timely and proper administration of examinations and defenses. Student's course grades are issued to the Graduate School and the student's advisor. The Institute administrative assistant (x3856) in 104 Rowley Laboratories maintains all other records on matriculated students.

## IV. APPLICATION PROCEDURES

The prospective student may apply for admission to either an M.S. or a Ph.D. degree. The degree of interest is noted on the application form. Applicants to the graduate program are required to pay an application fee at a rate determined by the Graduate School. This fee cannot be waived or deferred,

except as follows. The fee will be waived for applicants from within the U.S. and Canada who apply for admission before December 31 for the following fall semester, or June 30 for the following spring semester. The full name of the applicant should be written on the front of all checks or money orders. Applications received without the fee are not forwarded to the Institute for review. They remain inactive until the fee is received. All applications must be submitted to the Graduate School.

## Application Requirements

The application should be completed through CollegeNet, our on-line application provider (https://www.applyweb.com/apply/clarksng/ ). The application package includes:

- The application form
- Personal statement
- A resume/CV
- Three reference letters (which can be requested and submitted on-line)
- Official transcripts from each school attended
- TOEFL (Test of English as a First Language: http://www.toefl.org) or ITELS (International English Language Testing System: http://www.ielts.org) for students from countries where English is not the native language, (minimum 550; CBT score of 213; IBT score of 80; ITELS- 6.5).
- GRE scores (no minimum score specified)
- Other information that would help the graduate committee evaluate the applicant's request for admission can also be submitted (e.g., published papers).

Each acceptance by the Graduate Committee is for one degree program only. Requests for a change in degree status (*e.g.* M.S. to Ph.D.) and re-applications must be reviewed by the ISE Graduate Committee.

Students with a B.S. or B.E. degree should apply for the M.S. program. Exceptional M.S. students can be invited to switch into the PhD program after one year of the MS program.

The completed application is sent to the ISE Graduate Committee for evaluation. The period required for evaluation of complete applications generally ranges between two and four weeks. Once the evaluated application returns to the ISE office, an acceptance or rejection letter is sent. Accepted foreign applicants usually require 6-8 weeks notice to obtain visas; however, students from the Peoples Republic of China, can require 3 months or more to acquire visas.

The ISE degree programs have a suggested application deadline for students requesting financial aid: January 31 for the subsequent fall semester and August 31 for the spring semester. The official University deadlines for students not requesting financial aid are May 1 for the Fall semester and October 15 for the spring semester. The deadlines are set to provide the departments with sufficient time for reviewing the student's file, and for decisions regarding acceptance and financial aid to be made in a timely manner. **No I-20s will be issued after June 15 for the Fall semester and November 15 for the spring semester.**

The TOEFL/IELTS scores are required because Clarkson University must verify all international students' English language proficiency when English is not the language spoken at home (first language). This requirement, as part of the application process, must be completed prior to the issue of an I-20. Once the university has verified this requirement, and the applicant is accepted, the I-20 may be used to obtain a student visa. The ISE Director may provide exceptions to the minimum score requirements in limited

cases. Exceptions apply only to the minimum score requirement unless the applicant fits one of the following criteria:

- Successfully completed at least one academic year at a school in the United States, or, a country where English is the primary language spoken (e.g., UK, Australia)
- Successfully completed an intensive English language course and received a certificate of completion.

All accepted international students, for whom English is a second language, are required to take an English-as-a-Second-Language placement exam (LA005) upon their arrival on campus and complete any recommended requirements. Language courses required as a result of the placement exam are not counted toward degree requirements.

## V. ACADEMIC ADVISING

During the first semester in residence, each graduate student is assigned a thesis advisor (**Graduate Advisor Form -** see links to on-line forms from Appendix C**)**. Graduate credit for courses taken at Clarkson as an undergraduate must be requested on a **Graduate Transfer Credit Form**. Written requests for transfer credit for courses taken at other schools must be approved by the Advisor and the Institute Director, and then submitted (Graduate transfer credit form) with official transcripts to the Graduate School. Courses for which transfer credit is granted should be included on the program form.

In addition to the above, and to ensure that a student is making progress towards a degree, each semester's academic class selection is approved by the Thesis Advisor during course selection and entered by the student through PeopleSoft. Course Selection materials will be distributed to each student via email prior to Course Selection week.

The Thesis Advisor, PhD or Thesis committee, the Institute Director, the Graduate Committee Chair, and the Graduate Dean must approve the completion of degree requirements before a student can graduate.

## VI. DUTIES AND RESPONSIBILITIES OF THE CLARKSON INSTITUTE FOR A SUSTAINABLE ENVIRONMENT

A. Selection of Candidates for Graduate Programs: The Institute makes decisions on admission.

B. Program Requirements: The Institute develops courses in conjunction with academic departments and defines thesis/dissertation requirements.

C. Seminar: The Institute develops a seminar program in conjunction with academic departments. Students should enroll in EV610 seminar. A form in **Appendix C** should be used to document your participation in campus seminars.

D. Candidacy Examinations: The Institute defines guidelines for the preparation and administration of examinations that may be both written and oral.

E. Research Assistantships: The Principle Investigator makes recommendations for the use of these funds for the support of graduate students and their research.

F. Graduate Students: The Thesis Advisor's department provides space and facilities for graduate students and may provide some financial support for graduate student research.

G. Fellowships: The Institute administers fellowships in accord with the requirements of the funding source and in consultation with the student's advisor.

## VII. DUTIES AND RESPONSIBILITIES OF EACH STUDENT

All graduate students at Clarkson are required to abide by the rules and regulations of the University and

Institute as set forth in the Catalog, Clarkson Regulations, and as contained in this Handbook. Students who have received a financial award administered through the University must abide by the University policy permitting the equivalent of **two weeks of vacation**, plus regular University holidays, during the calendar year. By University policy, the service requirements of Teaching Assistants amount to *the equivalent* of 12 hours per week for 50 weeks for a 1-year appointment (600 hours). This means a Teaching Assistant could be asked to work 20 hours per week during each of two 15-week semesters, including time for preparation and grading. Teaching Assistants with such a workload would have no further commitment of teaching assistant duties. This includes the time between semesters or during the summer. Similarly, by University policy, full time Research Assistants are required to work 40 hours per week for their stipend and tuition, less time spent in class, for the duration of their appointments.

The ESE graduate coordinator, and Institute Director must be advised in writing of a leave of absence. In addition, the University's International Advisor must also be notified of travel or leave of absence by international students.

## Seminar Attendance

All graduate students are required to attend seminars to broaden their knowledge of science, mathematics and engineering fields and applications. For EPG student, such seminars should reflect policy and governance knowledge. Students are expected to attend seminars every semester and will receive one credit per semester for meeting seminar attendance guidelines. The concurrent enrollment of two credits of seminar is discouraged.

## Presentation and Publication Expectations

The Institute has requirements and standards for M.S. and Ph.D. students to ensure the timely dissemination of research results.

Presentations:

MS students are expected to present their research work on at least one occasion other than their defense. PhD students are expected to present their research work on at least two occasions other than their defense. Either seminars or presentations at research conferences are appropriate forums for this presentation.

Publications:

It is expected that material presented in a thesis or dissertation be of sufficient quality for publication in a peer-reviewed research journal. Research efforts of Ph.D. students should, in general, be sufficient for multiple manuscripts, while at least one is expected of M.S. degree recipients.

With a need to disseminate the research results, it is acceptable and encouraged to organize a thesis or dissertation around manuscripts prepared for submission to appropriate peer-reviewed journals. Dissertations comprised of several manuscripts must also include an overall introduction and conclusion to tie the material together. Additional materials required for the thesis or dissertation (detailed literature review, details of methods, presentation of raw data, etc.) can be included as additional chapters or appendices as appropriate.

When a dissertation or thesis is comprised of manuscripts prepared for a peer-reviewed journal, it is expected that the student be the primary author of these manuscripts. First authorship has important connotations; it implies not only that the student understands all aspects of the work, but also that she/he handled major facets of the research and writing tasks independently.

Scholarly work and its dissemination through peer-reviewed, archival publication(s) are expected of most MS and all PhD students.

With the advisor approval, students are encouraged to organize their thesis or dissertation around a manuscript (MS thesis) or collection of related manuscripts (PhD dissertation) to facilitate further dissemination of the scholarly work. Students are expected to be the primary author on any manuscript included in the thesis or dissertation and are required to specify their contribution to multi-authored works.

## Research Ethics and Intellectual Property Issues

Graduate students are expected to follow University defined rules related to academic integrity and intellectual property. This includes following the

- ***Code of Student Conduct***, which prohibits all forms of academic dishonesty, including cheating, fabrication, plagiarism and aiding and abetting of a dishonest act. (http://www.clarkson.edu/studentaffairs/regulations/v.html)
- ***Intellectual Property Policy***, which applies to graduate students and the work produced by graduate students. Details of the IP policy are included on the University's web site (http://www.clarkson.edu/dor/documents/IP_Policy_092505.pdf). The following is a general summary and guidelines for students:
    - With the exception of graduate theses and dissertations, ownership of intellectual property produced by members of the Clarkson community (including students, whether or not they are funded by the University) generally belongs to the University.
    - Graduate student advisors are expected to share aspects of research contracts with their students that pertain to confidentiality and IP issues. Graduate students are expected to abide by these contract rules.
- ***Copyright Laws***, which pertain to how to avoid infringing on someone else's copyright and how to protect the student's own copyright. The book by Kenneth Crew[1] thoroughly addresses copyright law and should be consulted for detailed explanations. Some general guidelines include:
    - The thesis or dissertation will likely include quotations, pictures, charts, standard tests, or other materials created by other authors. Permission to use such materials from the copyright owner is often required before borrowing the "expression" of other works. Giving full credit and citations does not exempt the dissertation author from the obligations of copyright law. Copyright law provides a right of "fair use" that allows limited copying-such as short quotations-without consent. However, **the student is required to obtain proper permission from the copyright owner for the following materials** that might be included in a thesis or dissertation[2]:
        - Long quotations from pre-existing materials that extend for more than one and one-half single-spaced pages.
        - Reproduced publications. Examples include copies of standard survey instruments or questionnaires, and the student's OWN journal articles already published.
        - Unpublished materials. Extensive reference to unpublished works raises a variety of issues about copyright and about privacy and access to collections.
        - Graphic or pictorial works. For example, copies of graphs or schematic diagrams included in your dissertation from previously published works.

[1] Crew, K.D., Copyright Law and Graduate Research: New Media, New Rights and Your Dissertation, ProQuest Inoformation and Learning, Ann Arbor MI, 2002. Available for free download http://www.proquest.com/products_umi/dissertations/copyright/
[2] From PQ/UMI® GradWorks Guide F2006.
http://www.il.proquest.com/dissertationagree/dissertation_publishing_agreement.pdf

        - Computer Software. Dissertations embodied in new media, such as on a website or on CD-ROM, may incorporate reader programs or other application software to make the new work accessible or useful. Reproducing such programs to accompany your dissertation will almost invariably require permission. Consult any license agreement, including those for "Shareware," that may apply to the programs, and prepare to seek permission from the copyright owner.
        - Sources located on the Internet. Easy availability does not change copyright status. Materials on the Web are protected by copyright just as if they appeared in a book or on tape.
    - Copyright permissions are generally given readily for student's use of their own works. However fees are sometimes charged for permission to use materials originally generated by a different author. See **Exhibit D** for a sample letter requesting permission to use copyrighted material.
    - Receipt of permission to use copyrighted materials needs to be noted in the thesis or dissertation. For example, a footnote stating: "Reproduced (or "Reproduced in part") with permission from [FULL REFERENCE CITATION]. Copyright [YEAR] [COPYRIGHT OWNER]."
    - Materials on the internet are automatically copyrighted by the person posting the materials. Care should be taken in posting research results prior to their publication elsewhere since some journals consider materials posted on the web to be "prior publication" and will not consider the manuscript for journal publication. Consult the author guide for the journals pertinent for publication of the student's research prior to posting information on the web. This includes conference publications or presentations that conference organizers might post on the web as well.
    - Copyright laws pertain to MS theses as well as PhD dissertations. The rules are enforced for PhD dissertations when they are submitted to ProQuest/UMI®. Although this same enforcement does not happen for MS Theses, it is still expected that they obtain required permissions for the use of copyrighted materials in their theses. In addition to complying with the laws, enforcing this requirement also helps to teach our students about the appropriate use of intellectual property.
    - The dissertation or thesis author automatically and immediately owns the copyright of materials in the dissertation (or has obtained permission to use the material by current copyright holders). However, students can include a copyright notice in their thesis/dissertation. The notice, which can be included on the page just after the title page should state: "Copyright [YEAR], [STUDENT NAME]", OR "© [YEAR], [STUDENT NAME]." Registering the copyright with the Library of Congress is technically optional. However, you have limited rights to protect your copyright (e.g., to file an infringement lawsuit) unless it was registered before the infringement occurred.

## VIII. GRADUATE POLICY ON COMMENCEMENT

In order for a graduate student to receive a diploma at the May Commencement ceremony:

- All coursework and seminar credits must be completed as specified by the degree requirements.
- Master's theses or Doctoral dissertations must be approved by the student's research committee, Institute, and Dean of the Graduate committee. All associated final and signed copies and paperwork must be submitted to the appropriate school office by the published deadline. This deadline is generally 10 working days before commencement in the spring or the last day of finals in the fall.

ESE graduate students who do not meet these requirements and deadlines *may* be allowed to participate in graduation ceremonies in the following cases:

**A student may "walk through" the May graduation ceremony if:**

- The student has defended his or her dissertation, thesis or presented their project, yet has failed to meet the published deadline for the final signed copies and completed paperwork.

OR

- The student is in a Master's degree program, has submitted an approved and signed thesis and requires no more than three additional credits of coursework.

Student requests to walk through the graduation ceremony require explicit approval by the Institute Director, with the approved request submitted to the Dean of the Graduate school at least 10 working days before the faculty votes to confer degrees at the May graduation.

In the case of an incomplete dissertation, thesis or project, the petition must be initiated by the thesis or project advisor and be approved by the Institute Director or comparable unit administrator. This petition should (a) certify that a successful presentation or defense of thesis had occurred prior to the published deadlines, and (b) carry the signatures of the thesis or project advisor, and all other members of the thesis examining committee indicating that they are confident that the remaining corrections to the thesis or dissertation can be completed by the student.

Students who are allowed to walk through the graduation ceremony under these conditions will receive their diploma and be counted as graduates at the next graduation ceremony following the completion of their degree requirement.

## IX. GRADUATE SCHOOL TUITION POLICY

A. Research/Teaching Assistants

Students on research (RA) or teaching (TA) assistantships will have their tuition expenses covered (up to a maximum of 15 credit hours per academic year semester and up to 6 credit hours over the summer term, not to exceed 30 credit hours per calendar year). The tuition fees are covered by the Graduate School, research account, or advisor's home department (TA) depending on the specific nature of the funding source. For RAs, the student needs to be appointed for at least six months and from funds derived from no more than three research grants.

B. Partial Tuition Scholarships

The Graduate School, upon recommendation by the Institute, may provide a scholarship to cover up to 12 credit hours of tuition (four credit hours per semester for M.S. students) for self-paying graduate students.

## X. REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

The Institute for a Sustainable Environment offers two M.S. Degrees: a Master of Science Degree in Environmental Science and Engineering (ESE) and a Master of Science Degree in Environmental Politics and Governance (EPG).

### Admission Requirements:

Applicants are expected to have completed at least one year of calculus, physics, and chemistry, have some background in Fluid Mechanics, and have obtained a B.S., B.E. or equivalent degree from an engineering or science program. Course deficiencies, as determined by the Admissions Committee,

should normally be removed before the first semester but must be removed before the start of the second semester. This course work may comprise an additional semester of study for which graduate credit cannot be granted.

No minimum grade point average is required for admission, however in general a GPA > 3.25 is expected in combination with a superior record of academic achievement. The Graduate Record Examination (GRE) is required of ALL applicants (subject test not required). The results of this test, together with the academic record and professional recommendations, form the basis for admission decisions and the awarding of financial assistance.

International applicants must submit a TOEFL score; a minimum of 550 (CBT score of 213 or IBT score of 80) is required although higher scores are generally required to receive financial aid. All accepted international students for whom English is a second language are required to take an on-campus ESL placement exam after arrival at Clarkson and complete any resulting requirements at no cost to them.

## University Requirements

(Consult current Clarkson Catalog for complete details)

The MS degree requirements defined by the University include:

- 30 Credit hours
  (up to 10 credit hours transferred (B or better); this could include distance learning courses taken from other Universities; complete **Graduate Credit Transfer Form** to arrange for credit transfer)
  - at least 18 credits of graduate coursework [3]
  - at least 2 credits of seminar
  - at least 6 credits of thesis
- ≥ 3.0 cumulative GPA in coursework contributing to degree requirements
- At least two semesters in residence
- All accepted international students, for whom English is a second language, are required to take an English-as-a-Second-Language placement exam (LA005) upon their arrival on campus. Recommended ESL courses must be completed.
- All work must be completed within 5 years

## Additional ESE Requirements

The requirements and guidelines for the M.S. degree are those noted above for the University and the Graduate School, subject to the following additional constraints, which are specific to the ESE Degree:

1. All students must complete a thesis and defend it orally to a committee consisting of a minimum of three faculty members. The student's advisor normally serves as committee chair.
2. Exceptional students may be invited to proceed to the Ph.D. after one year of the M.S. program; such students will be awarded the M.S. upon completing 40 credit hours and passing the doctoral qualifying examination with a superior grade. This change in status is initiated by the faculty adviser and requires the approval of the graduate committee.
3. The courses selected for each student should be chosen based on the student's research

[3] Graduate course work defined as ≥ 500 level. Those students who are not fully prepared to pursue graduate work in engineering may be required to take additional course work for which graduate credit will not be given.

direction and should provide sufficient breadth and depth to allow for the student's future intellectual development.

4. The student must take one of EV 532 (Risk Analysis), EC 660 (Environmental Economics), CE 586 (Industrial Ecology) or CE 582 (Environmental Systems Analysis).
5. Each student must take at least two courses from at least one of the ESE course groupings (Biology and Ecology, Chemistry and Physics, Fluid Mechanics and Transport, Control Technologies) or equivalent as determined by the Director and published in the current handbook. See Appendix A.
6. Each student must take at least three courses from the Coulter School of Engineering.

## Additional EPG Requirements

The requirements and guidelines for the M.S degree are those noted above for the University and the Graduate School, subject to the following additional constraints, which are specified to the EPG degree.

1. The courses selected for each student should be chosen based on the student's research direction and should provide sufficient breadth and depth to allow for the student's future intellectual development. There are three core courses which all students must take: POL/SOC 570 Environmental Policy (the principle organizing course for the entering cohorts), ES 532 Risk Analysis and EC 660 Environmental Economics.
2. In addition the electives are divided into three categories: Environment and Society, Environmental Philosophy and Environmental Policy (Appendix B). Beyond the core, students must take at least one elective course from each of the three categories.
3. In addition, if the students have not taken a course on American Politics or American Society, social science research methods and/or introduction to environmental science, they must take, for no graduate credit, POL 220: American Politics, SS380: Research Methods and/or EV313: Environmental Science.
4. In the summer while completing thesis work all graduate students will complete a 1 credit Graduate Student Research Discussion Seminar where students can share and discuss their research projects.

## M.S. Thesis Committee

The research advisor must be an affiliate of the Clarkson Institute for a Sustainable Environment (Institute affiliation is open to all Clarkson faculty who participate in Institute activities). The research advisor, in consultation with the student and approval of the Institute Director, selects the M.S. Thesis Committee within twelve months after entry into the M.S. program. This committee must consist of three members above the rank of instructor.

## M.S. Thesis Procedures

These instructions are provided to assist in the preparation and completion of the thesis. These are basic guidelines to be used in thesis preparation, however, if you have a concern that is not addressed, please contact your advisor or the Chair of the Graduate Committee for clarification.

A. Preparation

See the MS thesis guidelines for requirements. A template in MS Word is also available to help with thesis formatting guidelines.

http://www.clarkson.edu/engineering/pdffiles/MS%20thesis%20procedures.pdf

http://www.clarkson.edu/engineering/graduate/GSA_thesistemplate_091008.doc

B. Thesis Defense

Each graduate student is responsible for making arrangements for a room and advertising of the thesis defense. Committee members, consisting of a minimum of three Clarkson Faculty members, are normally permitted approximately 10 working days to read the thesis.

The defense serves two purposes: examination on specific aspects of the thesis in order to establish the student's depth of understanding of the subject, and an examination on the broader field of study to determine the general level of mastery. At the conclusion of the defense, the Chair (normally the thesis advisor) completes the **Graduate Student Completion Form** and submits it with the completed thesis. There is no limit to the number of times a thesis may be defended, provided the longevity requirement has not been exceeded (5 years).

C. Submitting the Thesis

Two copies of the signed final thesis (once all corrections have been completed) are to be submitted to the Graduate School for the Dean's signature. The original will not be signed by the Dean and will not be accepted as a copy. In addition the Institute must also receive one hard copy of the final thesis and a CD with the complete document in one PDF file to be kept in the Institute library.

The thesis must be bound in a two or three hole flat style report cover (no three ring binders). The following completed items must also be submitted with the final thesis copies:

- A Graduate Student Completion Notice
- Final degree program form
- Withdrawal form (including International Withdrawal Form if an International student)
- Termination form

D. Final Acceptance Date Prior to Commencement

Final copies of the thesis must be received in the Graduate School no later than ten class days prior to a Commencement to qualify a student to receive the degree at that Commencement.

E. Final Acceptance Date Prior to the Beginning of the Semester

Final copies of the thesis must be received in the Graduate School no later than the second week of classes (last day to register) or the student must register and pay tuition for one credit hour of thesis.

## XI. REQUIREMENTS FOR THE PH.D. DEGREE IN ENVIRONMENTAL SCIENCE AND ENGINEERING

### Admission Requirements:

Applicants are expected to have completed at least one year of calculus, physics, and chemistry. Most students enter the Ph.D. program following completion of an M.S. degree. Exceptional students may be invited to proceed directly to the Ph.D.; such students will be awarded the M.S. upon completing 40 credit hours and passing the doctoral qualifying examination with a superior grade. This change in status is

initiated by the faculty adviser and requires the approval of the graduate committee. Course deficiencies, as determined by the ISE Graduate Committee, should normally be removed before the first semester but must be removed before the start of the second semester. This course work may comprise an additional semester of study for which graduate credit cannot be granted.

No minimum grade point average is required for admission, however in general a GPA > 3.25 is expected in combination with a superior record of academic achievement. The Graduate Record Examination (GRE) is required of ALL applicants (subject test not required). The results of this test, together with the academic record and professional recommendations, form the basis for admission decisions and the awarding of financial assistance.

International applicants should submit a TOEFL score; a minimum of 550 (CBT score of 213 or IBT score of 80) is required although higher scores are generally required to receive financial aid. All accepted international students for whom English is a second language are required to take an on-campus ESL placement exam after arrival at Clarkson and complete any resulting requirements at no cost to them.

## University Requirements

(Consult current Clarkson Catalog for complete details)

1. 90 credit hours minimum (beyond the B.S.), corresponding to a minimum to three academic years of full-time study, a minimum of nine course credits must be obtained at Clarkson.
    a. A maximum of 30 credits (B grade or better) may be transferred from a Master's degree towards the Ph.D. degree. Official transcripts must be provided before transfer credit is awarded
    b. A minimum of 24 credit hours of course work
    c. A minimum of 6 credit hours of seminar
2. All work to be completed within seven years after the candidacy procedure is completed.
3. All students must complete the candidacy procedure within two years after admission to the Ph.D. program. A student may have two attempts to pass the candidacy procedure. If a student fails in the first attempt, he/she has two months to make a second attempt. A student who does not complete the candidacy procedure within the time allowed will be dropped from the graduate program.
4. A dissertation must be submitted and defended orally before an approved committee.
5. A student in the Ph.D. program who has not yet completed the candidacy procedure will be called a Ph.D. Student. After the procedure has been completed, the student will be called a Ph.D. Candidate.

## Institute Requirements

(In addition to University requirements)

The requirements and guidelines for the Doctoral degree are those noted above for the University and the Graduate School, subject to the following additional constraints, that are specific to the ESE Degree:

1. Programs of study will be developed for each student in conjunction with a faculty advisor based on the student's research direction and should provide sufficient breadth and depth to allow for the student's future intellectual development. For many students this will require completing more than the 24 course credits indicated above.
2. The student must take at least two courses from at least two of the ESE course groupings

(Biology and Ecology, Chemistry and Physics, Fluid Mechanics and Transport, Control Technologies) (See Appendix A)

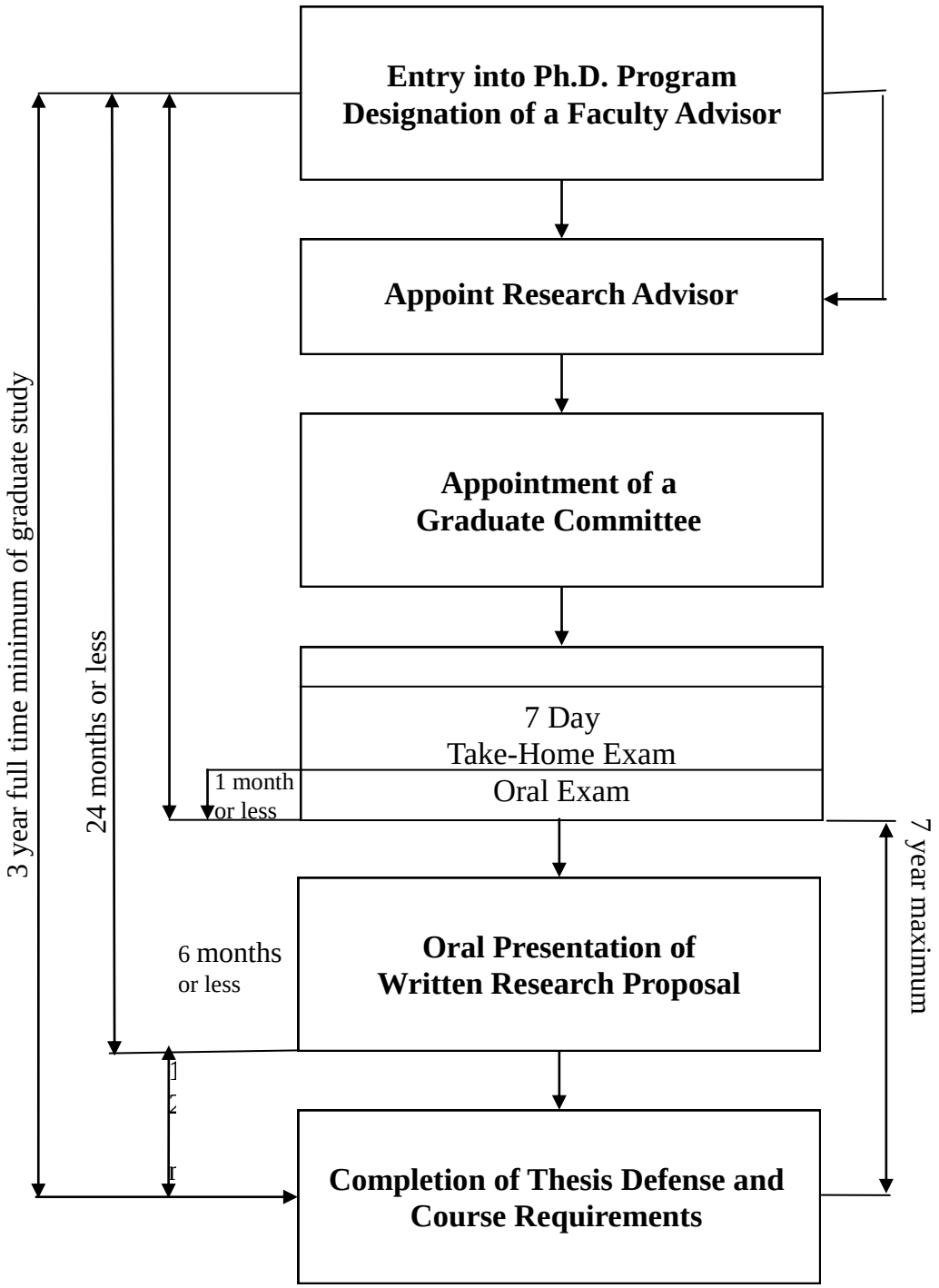
3. The student must take one of ES 532 (Risk Analysis), EC 660 (Environmental Economics), CE 586 (Introduction to Industrial Ecology) or CE 582 (Environmental Systems Analysis) or equivalent as determined by the Director and published in the current catalog.
4. Program of study forms must be completed by the student and advisor every semester. These forms should be approved by the advisor and submitted to the ISE office for approval by the ISE Director each semester.

## PhD Committee

The research advisor must be an affiliate of the Clarkson Institute for a Sustainable Environment (Institute affiliation is open to all Clarkson faculty who participate in Institute activities). The research advisor, in consultation with the student and approval of the Institute Director, selects the Ph.D. Committee within twelve months after entry into the Ph.D. program (**Graduate Committee Appointment Form**). This committee must consist of five members qualified to serve on such a committee. The members should include at least four Clarkson faculty members with rank of Assistant Professor or higher and possessing an earned doctoral degree, at least one of whom must be from outside the candidate's department. With the approval of the Graduate School (Provost), an external examiner with appropriate credentials from another University or industry may also be appointed to serve as one of the five committee members. The purpose of the committee is to provide guidance to the student in the project-related course work and research.

## Candidacy Procedure

A qualifying examination must be taken within eighteen months after entry into the Ph.D. program, as determined by the initial date of matriculation or, for a Master's student continuing for the Ph.D., the date of acceptance to the Ph.D. program (see flowchart). This examination will have a written portion consisting of a one-week take-home exam with access to research materials, and an oral portion to be administered by the Thesis Committee within one month after the conclusion of the written exam. In the event of failure of the written exam, the Thesis Committee may, at its discretion, elect not to administer the oral portion. The outcome of the exam is determined by a vote of the committee, with no more than one dissenting vote permitted for passage. Failure of the qualifying examination twice is grounds for dismissal from the program. Upon successful completion of this examination and submission of the**Environmental Science and Engineering Candidacy Exam Form** the student is admitted to candidacy for the Ph.D. degree.


Entry into Ph.D. Program
Designation of a Faculty Advisor
Appoint Research Advisor
Appointment of a
Graduate Committee
7 Day
Take-Home Exam
Oral Exam
1 month
or less
Oral Presentation of
Written Research Proposal
6 months
or less
Completion of Thesis Defense and
Course Requirements
3 year full time minimum of graduate study
24 months or less
7 year maximum

## Research Proposal Presentation

Within six months after the successful completion of the preliminary examination or 24 months from matriculation, the Ph.D. student must submit and orally present a research proposal to the Ph.D. Advisory Committee. This presentation may be administered simultaneously with the oral portion of the preliminary examination. The research proposal must:

1) Identify a problem that is worthy of investigation.
2) Provide background materials that demonstrate an understanding of the fundamentals related to the problem.
3) Provide background materials that identify the current state-of-the-art in terms of understanding the problem and clearly identify current gaps or limitations in the research work already completed by others.
4) Establish and justify the goals and objectives*.
5) Present any preliminary work to provide confidence that the problem is important and that the research is realistic.
6) Lay out a plan for the research investigation
   a) Experimental materials and methods, equipment used, design of an experimental matrix, quality control, plan for data analysis and interpretation; or
   b) General mathematical tools used, model development procedure, approach to test or verify model, application of the model, analysis and interpretation of results.
   c) Proposed timeline and major deliverables or milestones such as technical publications, draft copy of portions of the thesis, etc.
7) Summarize the expected outcomes of the research work and their contribution to the current state of the art.

*** Defining the objectives of your research is critically important.**
It should be noted that the objectives of your research define the OUTCOME, i.e. what will be learned. They are not a statement of the approach or tasks that are required to meet these objectives.
Some examples of reasonable research objectives:

- Determine the effect of Marangoni convection on mixing of molten glasses
- Predict the extent of mechanical degradation of polymers

These both define the resulting outcome (prediction, effect on…) so they are objectives.
The related tasks or research approach could be:

- Solve a set of coupled non-linear PDEs…
- Perform experiments on…

These define the required steps; they do not define the outcome so they are NOT objectives.

## Dissertation and Final Examination

The student must pass a final public oral examination based on the dissertation that is presented to the PhD committee. The Thesis Advisor will serve as the chair of the committee. The student and his/her advisor are responsible for making arrangements for a room and advertising the dissertation defense. Announcements must be distributed at least two weeks in advance of the defense. The advisor should ascertain that the dissertation is sufficient for the defense; copies of the dissertation should be provided to each member at least 10 working days prior to the defense to give each member adequate review time unless all members of the committee agree to a shorter period.

A. Preparation

See Graduate School web site for detailed instructions for completion of a PhD dissertation (http://www.clarkson.edu/engineering/pdffiles/PhD%20dissertation%20procedures.pdf )

The Dissertation needs to be an original and scholarly body of work. As discussed above, publication of aspects of the dissertation is expected of all students. Subject to advisor approval, papers written for publication can comprise the main body of the dissertation, with additional introductory and concluding chapters. The following aspects are expected of all dissertations:[4]

***Attributes and Expectations of a PhD Dissertation***

**Overall contribution of the dissertation**

- Research makes a contribution to the field and that contribution is clearly stated.

**Communication**

- Writing follows standards of acceptable technical writing
- Organization is appropriate and logical
- Visual/graphics added to increase interpretation and are of appropriate resolution
- Meets ethical standards – free of plagiarism and includes copyright permissions as necessary

**Problem definition**

- Clearly defines a question or problem and/or hypothesis and justifies its importance

**Mastery of subject and relevant literature**

- Displays an understanding of the current state of knowledge in the discipline through synthesis of literature
- Applies theory to the problem

**Research methods**

- Uses appropriate research methods to address the problem
- Develops a research plan that clearly addresses the objectives and hypothesis
- Research plan includes a means of assessing the quality of the results (reliability, accuracy, reproducibility etc.)

**Results/Analysis**

- Presents results with appropriate graphical and tabular formats to support interpretation
- Explores issues and connections with statistics and/or theoretically to show understanding and depth of interpretation
- Relates results and discussion to objectives, hypothesis, and other literature
- Results are significant and make a contribution to the current state-of-knowledge
- Conclusions tie the whole thing together

**Contributions**

- Original and creative.
- Could changes the way people think
- Opens new areas for research

**Publications and potential publications.**

- Is publishable in peer-reviewed archival publications

**Presentation and defense of research**

- Well organized and professional,
- Questions are addressed in a knowledgeable and respectable manner.

B. Defense of the Dissertation

The procedures for and purpose of the dissertation defense are similar to those given for the Master's degree, except for the composition of the Examining Committee as noted.

[4] Adapted from: Lovitts, B.E., How to Grade a Dissertation, *Academe OnLine*, Nov-Dec 2005, American Association of University Professors (http://www.aaup.org/AAUP/pubsres/academe/2005/ND/Feat/lovi.htm )

C. Submitting the Ph.D. Dissertation

Two copies of the dissertation (once all corrections have been completed) are to be submitted to the Graduate School in loose form without holes. You may place folders around each copy for protection. In addition the Institute must also receive one spiral bound copy of the final dissertation to be kept in the Institute library and one PDF file of the entire dissertation on a CD.

It should be noted that the dean will not sign the original dissertation and it cannot be used as a copy for the Graduate School.

The dissertation must be accompanied by a $110 fee (subject to change) to cover the costs of ProQuest/UMI microfiche and binding.

In addition to the dissertation, the following completed items obtained from the Institute Secretary must be submitted to the Graduate School:

- A degree completion notice
- ProQuest/UMI® Dissertation Submission Form and Optional order form for bound copies (http://www.il.proquest.com/products_umi/dissertations/submitted_authors.shtml )
- Survey of Earned Doctorates
- Final Degree Program form
- Withdrawal form

Final copies of the dissertation must be received in the Graduate School no later than ten class days prior to a Commencement to qualify to receive the degree at that Commencement.

For dissertations completed at the beginning of a new semester, the final approval of the dissertation and related completion forms must be received in the Graduate School by the deadline for the new semester check-in or the student must register and pay tuition for one credit hour of thesis.

## APPENDIX A - Environmental Science and Engineering Courses

(four major subgroups). Substitutions must be approved by the Institute Director.

| **Biology and Ecology (life sciences)[1]** | **Chemistry and Physics[1]** |
|---|---|
| BY 520 Microbiology<br>BY 525 Biological Systems & Environmental Change<br>BY 531/CE 589 Limnology<br>BY 620 Evolution<br>BY 659 Systems Biology<br>BY 620 Evolution<br>EHS 518/BY 518 Principles of Toxicology and Epidemiology | CE 576 Atmospheric Chemistry<br>CE 580 Environmental Chemistry<br>CH 509 / CM 509 Receptor Modeling in Environmental Chemistry<br>CM 530 Colloids and Interfaces<br>CM 532 Particle Size Analysis in Dispersions and Other Colloids<br>CM 552 Aerosol Chemistry<br>EV536 Climate Change: Science, Engrg. and Policy<br>EHS 505 Methods and Analysis |
| **Control Technologies[1]** | **Fluid Mechanics and Transport[1]** |
| CE 579 Water and Wastewater Treatment Processes<br>CE 581 Hazardous Waste Management Engineering<br>CE 681Environmental Physico-Chemical Processes<br>CE 682 Environmental Biological Processes<br>CE 686 Environmental Engineering Design<br>ES 534 Air Pollution Control<br>EHS 506 Industrial Hygiene Control Methods<br>EHS 581 Advanced Topics in Environmental and Occupational Health | EV 535 / CE 535 Groundwater Hydrology and Geochemistry<br>CE 570 Advanced Hydrology<br>CE 572 Shallow Water Hydrodynamics<br>CE 573 Sediment Transport<br>CE 574 Hydrodynamic Dispersion<br>CE 583 Modeling Natural Aquatic Systems<br>CE 584 Chemodynamics<br>CE 576 Hydraulic Engineering in Cold Regions<br>CE 587 Contaminant Transport in Groundwater<br>ME537 Fluid Mechanics of Aerosol Dispersions<br>ME 538 Experimental Aerosol Mechanics and Instrumentation<br>ME 637 Particle Transport and Deposition<br>ES 533 Human Exposure Analysis |

Check course catalog for class prerequisites

## APPENDIX B - Environmental Politics and Governance Courses

**Required Courses[1]:**
ES 532 Risk Analysis
EC 660 Environmental Economics
POL/SOC 570 Environmental Policy

**Electives:**

| | |
|---|---|
| **Environment & Society[1]**<br>ANTH 570 Environment, Technology and Society<br>ANTH/SOC 585 Food and Society<br>POL 573 Environmental Justice (ON-LINE)<br>SOC 593 Health, Wealth, Inequality and the Environment | **Environmental Philosophy[1]**<br>PHIL 570 Environmental Ethics<br>PHIL 580 Environmental Philosophy Seminar<br>POL 592 Environmental Political Theory |
| **Environmental Policy[1]**<br>PHIL 571 Energy and Society<br>SOC 572 Biofuel and Farm Policy<br>POL 572 Environmental Law<br>CE 586 Introduction to Industrial Ecology<br>POL 571 Energy Policy<br>POL 574 Policy Networks: Public Policy and Social Networks | **Open Category[1]**<br>SS 580 Directed Study in Research Methods<br>SS XXX* Graduate Student Research Discussion Seminar |

* Planned courses have XXX as a number
[1]Check course catalog for class prerequisites