

**WELCOME TO THE
GRADUATE PROGRAM:
CHEMICAL AND
BIOMOLECULAR ENGINEERING
CLARKSON UNIVERSITY**

2011 - 2012

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DEPARTMENT OF CHEMICAL and BIOMOLECULAR ENGINEERING

General Information for New Graduate Students

I. Introduction

Welcome to the Department of Chemical and Biomolecular Engineering. We hope that your stay will be enjoyable and rewarding. You will find information regarding the Chemical and Biomolecular Engineering graduate program at <http://www.clarkson.edu/chemeng/graduate/>

A campus map can be found at <http://www.clarkson.edu/about/map.php> and an academic calendar at <http://www.clarkson.edu/sas/calendar.html>.

II. University Orientation and Registration

Please see Attachment 7 for details on the orientation program planned by the Department and the University, the procedure for registration, and ESL (English as a Second Language) requirements.

III. Courses

A complete course listing for this semester is contained in your registration packet. It is called the Master Schedule. You can also visit the website for the Student Administrative Services (SAS) at Clarkson at <http://www.clarkson.edu/sas> to see the Master Schedule online, as well as a complete list of course(s) offered in the spring and fall. This will help you in selecting elective courses.

Thesis Research and Seminar Program

All students must begin thesis research as soon as they are assigned to a thesis advisor. Regardless of whether you are registered for seminar or not in a given semester, you must attend all seminars. Each graduate student in the M.S. program is required to present one talk in the graduate student seminar program organized by a committee of senior graduate students typically during the third semester in residence. Each graduate student in the Ph.D. program is required to present a talk in the graduate student seminar program once a year, and give a full length departmental seminar during the student's final year in residence. For more details about the graduate student seminar program, please see Attachment 8.

M.S. Students

First Semester

M.S. students who are on a Teaching Assistant (TA) appointment should register for a total of 15 credits. This will consist of 1 credit of seminar, 5 credits of thesis, and 3 three-credit courses. Of these, two are required courses, and the third is an elective. M.S. students who are on a Research Assistant (RA) appointment should register for a total of between 12 and 15 credits in consultation with their advisor. The credits taken should include 1 credit of seminar, and a minimum of 2 credits of thesis, along with 3 three-credit courses. A list of required courses can be found later in this handbook.

Students on partial tuition scholarships should register for a minimum of 10 credits each semester until they have completed all the requirements.

Individuals with an undergraduate degree in Chemistry have a different schedule and should see the Graduate Committee Chair to select their schedule.

Second Semester

Same as in the first semester – 15 credits for students on a TA appointment, and 12 to 15 credits in consultation with the thesis advisor for those on an RA appointment.

Additional Semesters

You should register for the remaining credits of thesis, if any, in the third semester. If all credit requirements have been completed, you should register for one credit of thesis each semester until the thesis is completed. If you are continuing for a Ph.D., please see the section below on Ph.D. Students.

Ph.D. Students

Students entering the Ph.D. program are usually on a Research Assistantship. They should register for 12-15 credit hours each semester until they satisfy the 90 credit hour requirement. They must register for at least 1 credit hour of thesis each semester, and no more than 1 credit of seminar each semester until the total requirement of seminar credits (6) has been completed. The Ph.D. Qualifying examination must be taken within twelve months following completion of the requirements for the Master of Science degree or arrival at Clarkson, whichever is later. Details regarding the examination are provided in Attachment 9.

Required Courses

Four courses are **required** for all graduate students. These are:

- CH560, Advanced Transport Phenomena (Fall)
- CH561, Chemical Engineering Analysis (Fall)
- CH571, Advanced Chemical Engineering Thermodynamics (Spring)
- CH546, Chemical Reactor Analysis II (Spring)

If you are uncertain about which elective course to take, you may wish to:

1. Seek advice from your thesis advisor or other faculty members.
2. Speak to the faculty member teaching a particular course to find out what will be covered in the course.
3. Sit in for a few class periods on courses that are of interest to you.
4. Consult with continuing graduate students.
5. Please note that, if you wish to add a different course to your program, this has to be done in the first two weeks of classes.

IV. Desks and Laboratory Assignments

Desk and laboratory assignments will be made by your advisor.

Please obtain a key to the CAMP building from Ms. Boyea (350 CAMP). A \$10.00 deposit is required for this key. See Ms. Gang (220 CAMP) or Ms. Hayes (222 CAMP) to obtain a key to your office and a key to the graduate mailroom (no deposit is required for these keys).

V. Mail, etc.

Please give your local address, local telephone number and laboratory assignment to Ms. Carrie Hayes (222 CAMP) as soon as possible.

Mail sent to the department can be found in the "Graduate Students" mailbox, Box 5707, in 232 CAMP.

Keep an eye on bulletin boards around the building for notices of interest.

VI. Teaching Assistant Assignments

For those of you who will hold appointments as teaching assistants, assignment of duties will be made during the first week of classes. You will be notified by a memo in your mailbox or via email. See the professor to whom you are assigned as soon as possible to discuss your duties.

VII. Thesis Research

Your work on thesis research must begin immediately. You are expected to make suitable progress on your research as well as receive good grades in your courses. Those students in the program for BS chemists will not select a thesis project until the spring semester.

VIII. Off-Campus Employment That Is Not Thesis Research

The department discourages off-campus employment for full-time graduate students receiving financial support from the University. This includes temporary full-time employment off campus. Such situations create undesirable breaks in the progress towards a degree and are not in the students' best interests. They may also handicap thesis advisors who are dependent on research progress to meet proposal, contract, or grant deadlines. Additionally, hardships in course coverage or in other tasks related to the teaching function may be created by those on teaching assistant appointments.

Nevertheless, in a few cases off-campus employment may be desirable. The work should be at a professional level in keeping with the student's education, related to the student's thesis project, and capable of enhancing overall career development. In such cases, the graduate student and the thesis advisor must both agree and then the Graduate Committee should be involved to assure that the above criteria are met. The Graduate School must also be informed to assure that immigration laws and other regulations are satisfied.

If a graduate student takes off-campus employment without permission, the department is not obligated to allow the student to return to former status.

IX. Computing Facilities - CAMP rooms 163, 171, and 172.

The Multidisciplinary Engineering Computer and Design Laboratory contains many networked workstations and PC's, with a wide variety of software. Room 171 is available at all times. Rooms 163 and 172 are sometimes reserved for courses. Special passwords are required in order to logon to the computers in those rooms. See your adviser if you need to use one of them.

X. Attachments

1. List of Chemical and Biomolecular Engineering Department Faculty & Staff
2. Requirements and Procedures for the Master's Degree
3. Master of Engineering Program in Chemical Engineering
4. Graduate Courses in Chemical Engineering Applications Acceptable for Master of Engineering degree in Chemical Engineering
5. Joint MBA/Master of Engineering Program in Chemical Engineering
6. Requirements and Procedures for the PhD Degree
7. Orientation, Registration Procedure, and ESL Requirements
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10. University and CSOE Requirements for the Master of Science Degree
11. University and CSOE Requirements for the PhD Degree

ATTACHMENT I

List of Chemical and Biomolecular Engineering Department Faculty and Staff

Faculty	Office	Telephone No.
Dr. S.V. Babu	CAMP 350	268-2336
Dr. Ruth E. Baltus (<i>Department Chair</i>)	CAMP 222A	268-6650
Dr. Sandra L. Harris	CAMP 238	268-2284
Dr. Phillip K. Hopke (<i>Graduate Committee Chair</i>)	CARES 206	268-3861
Dr. Sitaraman Krishnan	CAMP 229	268-6661
Dr. Richard J. McCluskey (<i>Department Executive Officer</i>)	CAMP 220	268-2303
Dr. John B. McLaughlin	CAMP 233	268-6663
Dr. Don H. Rasmussen	CAMP 218	268-3820
Dr. R. Shankar Subramanian	CAMP 217	268-6648
Dr. Ian I. Suni	CAMP 236	268-4471
Dr. Ross Taylor	CAMP 244	268-6652
Dr. Selma M. Thagard	CAMP 243	268-4423
Dr. William R. Wilcox / Dr. Liya L. Regel	CAMP 320	268-7672
Staff		
Ms. Carrie Hayes	CAMP 222	268-6650
Ms. Jean Gang	CAMP 220	268-6665

Requirements and Procedures for the Master's Degree

The University and the Coulter School of Engineering have certain requirements for the Master of Science Degree. These can be found in Attachment 10. The requirements of the Department of Chemical and Biomolecular Engineering for the M.S. degree are listed below. Where applicable, these apply in addition to the University and CSOE requirements.

CHEMICAL ENGINEERING M.S. REQUIREMENTS

A.) M.S. Degree Program Requirement

1. The following are **required** courses:
 - CH546 Chemical Reactor Analysis II
 - CH560 Advanced Transport Phenomena
 - CH561 Chemical Engineering Analysis
 - CH571 Advanced Chemical Engineering Thermodynamics
2. Two additional three-credit hour technical graduate courses selected in consultation with the student's advisor. School of Business courses cannot be taken to satisfy this requirement.
3. Two credit hours of CH610 (Seminar). (While in residence, all students are required to attend seminar, whether they are registered for CH610 or not.)
4. Ten credit hours of CH611 Thesis. All students are expected to start their thesis research at the beginning of their first semester in residence.
5. The M.S. thesis must be orally presented and defended before a committee of three or more faculty members, at least two of whom are from the Department.

The one-credit course, ES542 Fundamentals of Research and Graduate Study, is highly recommended. This course may be used as a substitute for one credit of CH611 thesis.

A typical schedule follows. Individuals with an undergraduate degree in chemistry have a different schedule - refer to "MS Degree in Chemical Engineering for BS Chemists and Physicists" on the next page.

First Semester

3 three-credit courses
5 credits of thesis
1 credit of seminar

Third Semester

1 credit of thesis (if necessary)

Second Semester

3 three-credit courses
5 credits of thesis
1 credit of seminar

Fourth Semester (if necessary)

1 credit of thesis

B.) Financial Assistance

Financial support for the M.S. degree, in the form of a tuition scholarship and a stipend, is offered to most incoming students. Continuation of this support is dependent upon remaining in good standing academically, performing thesis research and additional duties as required and making adequate progress in these areas. If it should become necessary to discontinue support, the student will receive prior written notification by the Graduate Committee. All students, whether supported as research or teaching assistants (except those in a special program for chemists or physicists), are expected to complete degree requirements within 16 months of the date of entry. Requests for continued support beyond this time period must be made in writing to the Graduate Committee.

C.) M.S. Degree in Chemical Engineering for B.S. Chemists and Physicists

A program is available for qualified B.S. chemists and physicists that will permit them to earn an M.S. in Chemical Engineering in four semesters. During the course of study, the student will take almost all the required courses in the chemical engineering undergraduate curriculum, as well as the chemical engineering graduate level courses required for the M.S. program.

A typical program, which may be altered depending on the background of the student, is illustrated below:

First Semester		Second Semester	
<u>Courses</u>	<u>Credits</u>	<u>Courses</u>	<u>Credits</u>
CH501 Directed Study in Chemical Engineering Principles I (Chemical Process Calculations, Fluid Mechanics, and Mass Transfer & Stagewise Operations)	4	CH502 Directed Study in Chemical Engineering Principles II (Heat Transfer and Applied Phase & Chemical Equilibria)	3
Graduate Elective	3	Graduate Elective	3
CH610 Seminar	1	CH610 Seminar	1
CH611 Thesis	2	CH611 Thesis	3
Total	10	Total	10
Third Semester		Fourth Semester	
<u>Courses</u>	<u>Credits</u>	<u>Courses</u>	<u>Credits</u>
CH503 Directed Study in Chemical Engineering Principles III (Chemical Reactor Analysis)	2	CH546 Chemical Reactor Analysis II	3
CH560 Advanced Transport Phenomena	3	CH571 Advanced Chemical Engineering Thermodynamics	3
CH561 Chemical Engineering Analysis	3	CH611 Thesis	3
CH611 Thesis	2		
Total	10	Total	9

REVISED – 8/12/09

ATTACHMENT 3

Master of Engineering Program in Chemical Engineering

Objective: To prepare the chemical engineer for a career in advanced engineering and design.

Prerequisites: B.S. or B.E. in chemical engineering. Those with degrees in other science or engineering disciplines may also be admitted, but will be required to make up undergraduate course deficiencies.

Normal program duration: One calendar year (12 months) for those with a B.S. or B.E. in chemical engineering.

Requirements:

Two graduate courses (6 credits) in chemical engineering fundamentals, to be selected from:

- CH546 Chemical Reactor Analysis II
- CH560 Advanced Transport Phenomena
- CH561 Chemical Engineering Analysis
- CH571 Advanced Chemical Engineering Thermodynamics
- CH586 Advanced Process Control
- CH590 Transport Phenomena

Two graduate courses (6 credits) in chemical engineering applications, to be selected from a list available from the Department of Chemical and Biomolecular Engineering.

Two graduate courses (6 credits) in business (500 or 600 level in AC, EB, EC, FN, IS, MG, MK, SB). Note that most of these courses have undergraduate prerequisites.

One graduate course (3 credits) in engineering, mathematics or science (500 or 600 level in BY, CE, CH, CM, CS, EE, ES, IH, MA, ME, MP, PH, PY, SU).

An additional graduate course (3 credits) in business, engineering, mathematics, science or communication and media.

Two credits of CH610 Chemical Engineering Seminar.

Four credits of CH611 Master of Engineering Project. A design project carried out under the direction of a chemical engineering faculty member, requiring the completion of a written report.

Typical program for Student Entering with B.S. in Chemical Engineering

Fall semester:	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	One business course	3 credits
	One technical elective	3 credits
	ChE seminar	1 credit
	MEng project	2 credits
	Total	15 credits
Spring semester:	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	One business course	3 credits
	One elective	3 credits
	ChE seminar	1 credit
	MEng project	2 credits
	Total	15 credits
Summer:	Complete MEng project	0 credits

Typical Program for Student Entering with B.S. in Chemistry or Physics

Fall semester:	CH501 Directed Study in ChE Principles I	1 credit
	Two graduate business courses	6 credits
	One graduate technical course	3 credits
	Total	10 credits
Spring semester:	CH502 Directed Study in ChE Principles II	1 credit
	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	ChE Seminar	1 credit
	MEng project	2 credits
	Total	10 credits
Summer:	Work on MEng project	2 credits
Fall semester:	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	ChE Seminar	1 credit
	MEng project	2 credits
	Total	10 credits

ATTACHMENT 4

Graduate Courses in Chemical Engineering Applications Acceptable for the Master of Engineering Degree in Chemical Engineering

All of the following are 3 credits. Not all of them are offered every year.

CH 509 Receptor Modeling in Environmental Chemistry

CH 515 Polymer Materials

CH 521 Process Intensification

CH 551 Multicomponent Mass Transfer

CH 576 Atmospheric Chemistry

CH 584 Polymer Processing

CH 612 Directed Study

CH 662-670 Special Topics

CE 579 Water and Wastewater Treatment Processes

CE 580 Environmental Chemistry

CE 581 Hazardous Waste Management Engineering

CE 582 Environmental Systems Analysis and Design

CE 586 Introduction to Industrial Ecology

CM 530 Colloids and Interfaces

CM 535 Better Materials through Chemistry

CM 551 Manufacturing Implications of Advanced Materials Processing

ES 534 Air Pollution Control

ES 552 Biomaterials and Biomedical Applications

ES 557 Integrated and Printed Circuit Fabrication

ES 564 Corrosion Engineering

MA 571 Numerical Solution of Differential Equations

MA 578 Numerical Analysis

MA 584 Advanced Applied Statistics

ME 515 Finite Element Methods

ME 529 Stochastic Processes in Engineering

ME 531 Computational Fluid Dynamics

ME 537 Fluid Mechanics of Aerosol Dispersion

ME 543 Advanced Optimal Design

ME 544 Advanced Computer Aided Design

ME 590 Advanced Welding Metallurgy

ME 595 Principles of Physical Metallurgy

Joint MBA / Master of Engineering Program in Chemical Engineering

Objective: To prepare the student for a career in management of technical organizations in management and government.

Prerequisites: B.S. or B.E. in chemical engineering. Those with degrees in other science or engineering disciplines may also be admitted, but will be required to make up undergraduate course deficiencies in chemical engineering.

Normal program duration: Two calendar years (24 months) for those with a B.S. or B.E. in chemical engineering.

Requirements:

Two graduate courses (6 credits) in chemical engineering fundamentals, to be selected from:

- CH546 Chemical Reactor Analysis II
- CH560 Advanced Transport Phenomena
- CH561 Chemical Engineering Analysis
- CH571 or CH573 Advanced Chemical Engineering Thermodynamics, Phase Equilibria
- CH586 Advanced Process Control
- CH590 Transport Phenomena

Two graduate courses (6 credits) in chemical engineering applications, to be selected from a list available from the Department of Chemical Engineering.

Two graduate courses (6 credits) in business. Normally these would consist of EB courses designed to meet the foundation requirements for entry into the MBA program. If the student has already taken these courses, then any 500 or 600 level in AC, EB, EC, FN, IS, MG, MK, SB would meet this requirement.

One graduate course (3 credits) in engineering, mathematics or science (500 or 600 level in BY, CE, CH, CM, CS, EE, ES, IH, MA, ME, MP, PH, PY, SU).

An additional graduate course (3 credits) in business, engineering, mathematics, science or communication and media. Normally this would consist of an EB course designed to meet the foundation requirements for entry into the MBA program.

Two credits of CH610 Chemical Engineering Seminar.

Four credits of CH611 Master of Engineering Project. A design project carried out under the direction of a chemical engineering faculty member, requiring the completion of a written report.

Management foundation requirements. MBA requirements (32 credits)

Typical Program for Student Entering with B.S. in Chemical Engineering

Foundation courses required for admission to the MBA program:

Summer:	AC205 Introduction to Accounting for Decision Analysis	3 credits
	LW270 Business Law	3 credits
	EC150 (or EC350) Principles of Microeconomics	3 credits
	<u>EC151 Principles of Macroeconomics</u>	<u>3 credits</u>
	Total	12 credits
Fall semester:	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	EB501 Corporate Finance	3 credits
	EB502 Organizational Behavior	3 credits
	ChE seminar	1 credit
	<u>MEng project</u>	<u>2 credits</u>
	Total	15 credits
Spring semester:	One ChE fundamentals course	3 credits
	One ChE applications course	3 credits
	Statistics (ES505,CM506 or MA383)	3 credits
	One technical elective	3 credits
	ChE seminar	1 credit
	<u>MEng project</u>	<u>2 credits</u>
	Total	15 credits
Summer:	MEng project	0 credits
	EB503 Principles of Marketing	3 credits
	<u>EB504 Operation Production Mgmt</u>	<u>3 credits</u>
	Total	6 credits
Second year: fall and spring semesters: MBA		32 credits
Second summer (if necessary): Complete MEng project		0 credits

ATTACHMENT 6

Requirements and Procedures for the PhD Degree

The University and the Coulter School of Engineering have certain requirements for the Doctor of Philosophy Degree. These can be found in Attachment 11. The requirements of the Department of Chemical and Biomolecular Engineering for the Ph.D. degree are listed below. Where applicable, these apply in addition to the University and CSOE requirements.

CHEMICAL ENGINEERING Ph.D. REQUIREMENTS

Ph.D. Degree Program Requirement

The following requirements apply exclusively to chemical engineering Ph.D. students.

1. Students entering the Ph.D. program should register for a minimum of 10 credit hours each semester until they satisfy the 90 credit hour requirement.
2. The student must take the four courses required for the M.S. degree program or their equivalent. A minimum of 15 credit hours must be in the major field, a minimum of 9 credit hours must be in the minor field, and a minimum of 6 credit hours must be taken from a department other than Chemical Engineering.
3. The student must take a qualifying examination and adhere to the guidelines described in Attachment 9: Ph.D. Qualifying Examination and Research Proposal Review.
4. The student must take the Ph.D. qualifying examination no later than 12 months after completing the M.S. requirements. Students given direct entry into the Ph.D. program must take the qualifying exam no later than 12 months after being invited into the Ph.D. program. Students entering with a M.S. degree must take the qualifying exam no later than 12 months from the time when they enter the graduate program.
5. Course work (minimum) = 30 credit hours (this is equivalent to 4 three-credit courses beyond MS) School of Business courses cannot be taken to satisfy this requirement.
Seminar = 6 credit hours
Thesis = 54 credit hours
6. While in residence, all students are required to attend all seminars.

Direct Entry into Ph.D. Program

First year graduate students whose past academic and first semester records at Clarkson indicate outstanding research potential will be invited to enter directly into the Ph.D. program. The thesis required in the regular M.S. program will be bypassed.

The department will decide which students will be invited into this program at the beginning of the second semester of the student's residence on campus. The M.S. degree is awarded to the student upon completion of 40 credit hours and after passing the Ph.D. qualifying examination.

Financial Assistance

Financial support for students enrolled in the Ph.D. program is usually in the form of research assistantships, and not teaching assistantships. Continuation of support is based on academic standing and research accomplishments, and may be terminated after written notification by the Graduate Committee for lack of acceptable progress in either area. Support will continue for no more than five years beyond the BS or three years beyond the MS, whichever is longer. Requests for continued support must be made in writing to the Graduate Committee.

REVISED-08/12/2009

ATTACHMENT 7

Orientation, Registration Procedure, and ESL Requirements

The Departmental Orientation will be held on Monday, August 22nd, at 3:00 P.M. in CA200. For graduate students entering in Fall 2011, the University will conduct several mandatory activities, including registration, during the week of August 22 - 26. For purposes of registration, you can pick up an ADD/DROP form in our Department office in Room 220 CAMP and fill it out with the courses that you will be taking in the Fall. Your thesis advisor, or the Chair of the Graduate Committee if you do not yet have a thesis advisor, will assist you in selecting courses and will also sign your registration forms, as needed. Registration will be held at the Student Administrative Services Office in the Cubley-Reynolds dormitory complex.

If you need a Social Security Number, you will need to provide Ms. Tess Casler, Graduate Foreign Student Advisor/Director, International Students and Scholars, with a local address where you will be living so that you can be registered in SEVIS. No application will be accepted by the Social Security office unless you have visited her office, located in Educational Resources Ctr. Transportation to Ogdensburg, where the Social Security office is located, will be arranged when the majority of the students have arrived. You cannot be paid without a social security number. Students are also advised to bring enough money to live on while waiting for their Social Security Card. You will find the international graduate student orientation schedule at <http://www.clarkson.edu/isso>.

ESL Requirements

Clarkson requires all foreign students for whom English is a second language to take and pass an ESL placement examination, and complete any resulting requirements. Currently, the requirements may be as many as two Clarkson courses designed specifically to improve English skills.

ATTACHMENT 8

Graduate Student Seminars

Seminars given by graduate students will be organized according to the following rules.

1. Departmental seminars will continue to be held on Tuesdays, but graduate student seminars will be organized on Thursdays. Each summer, the Department Chair will appoint a seminar committee of three senior doctoral students to organize the graduate student seminar series for the academic year, under the guidance of the faculty member assigned to organize the departmental seminars.
2. Two graduate students will present talks on each Thursday during the seminar period, which lasts approximately 45 minutes. While faculty members will not routinely attend graduate student seminars, graduate students are encouraged to invite selected faculty members, such as those on their thesis committee, to their talk. The introduction of the speakers and moderation of the talks will be arranged by the seminar committee members.
3. Each doctoral student is required to give one seminar as part of the graduate student seminar series every academic year, with the exception of the final year in which the student expects to complete and defend the doctoral thesis. In that year, the doctoral student will, instead, present a full length departmental seminar organized by the faculty member in charge of departmental seminars.
4. Each Master's student is required to present one seminar, typically during the third semester in residence, as part of the graduate student seminar series.
5. Graduate students are required to attend all seminars, and are expected to participate actively in the discussion.

Revised in Fall 2009

Ph.D. Qualifying Examination and Research Proposal Review

Within twelve months following completion of requirements for the Master of Science degree or arrival at Clarkson (whichever is later), the student must complete a “Doctoral Research Proposal” and submit this proposal to the Examining Committee. For students with a B.S. degree who, because of demonstrated exceptional abilities, are permitted to seek direct entry into the Ph.D. program, the proposal must be completed within twelve months of entry into the Ph.D. program. The student must meet with the Examining Committee as early as possible after being admitted to the Ph.D. program to discuss plans for the Research Proposal. No earlier than one full week subsequent to submission of the Research Proposal, the committee members and the student will meet to conduct a Ph.D. qualifying examination. The student will formally present the contents of the proposal to the committee in the form of a seminar of approximately 30 to 45 minutes duration. The presentation will be followed by an oral defense of the proposed research and related topics.

The purpose of the preliminary meetings, presentation, and the defense is three-fold:

1. To determine whether or not the student is capable of and qualified for the Ph.D. program.
2. To acquaint the members of the Committee with the subject of the student’s research and to elicit their suggestions on and criticisms of the proposed approach.
3. To insure that adequate progress is being made throughout the twelve month period toward defining a Ph.D. research program.

Each of these items requires the student to have a comprehensive understanding of the Ph.D. project.

A student who violates the twelve month time limit will not be allowed to register for additional thesis credits during subsequent semesters until the qualifying examination is passed. The student must, however, maintain full-time status. Additionally, financial aid will not be renewed beyond the initial twelve month period unless the student has passed the examination.

The Examining Committee, which will also serve as the student’s Doctoral Committee, will consist of a minimum of five members, including the student’s thesis advisor and at least one faculty member from a department other than Chemical and Biomolecular Engineering. At least four of the committee members must be on the Clarkson faculty. One or more external examiners, holding the Ph.D. degree, may also serve on the Committee. The thesis advisor will recommend the names of prospective committee members to the Graduate Committee. The Graduate Committee, with the approval of the Graduate School, will appoint the Examining Committee. While the thesis advisor will serve as the Chair of the Doctoral Committee, the advisor will not be the Chair of the Examining Committee. Hence, the advisor should also recommend a Chair to the Graduate Committee.

The research proposal itself should represent roughly six months effort in defining a problem, reading pertinent literature, specifying plans for theoretical and/or experimental work and writing the report. At least seven typed copies of the proposal should be prepared, one for each member of the Examining Committee, the Department, and the student. A Master's Thesis does not constitute a Doctoral Research Proposal, for which a suggested outline is attached. In particular, the proposal should stress the definition, importance and uniqueness of the problem.

The Chair of the Examining Committee will be responsible for conducting the meeting and for reporting to the Graduate Committee the Examining Committee's recommendation on the entrance of the student into the Ph.D. program. The day following the examination, the Chair will receive from each person on the Committee her/his written vote on the student. The vote will be one of the following:

1. Pass. The student is clearly Ph.D. caliber.
2. Fail. The student is clearly not Ph.D. caliber.

The Chair of the Examining Committee will collect and summarize the vote for the other members of the Committee. The summary will be forwarded by the Chair to the Graduate Committee within two days. The Chair of the Graduate Committee will inform the student, in writing, of the decision of the Examining Committee. The student may retake the exam within one month if the final vote is "Fail".

If, subsequent to the qualifying examination and during the course of the doctoral research, the student or thesis advisor decides that a significant change in the direction of the research project is warranted, the student's Doctoral Committee should be so informed. A re-examination of the student will not be involved. In any event, it is recommended that annual meetings be held with the Doctoral Committee to review the student's progress and to agree on work remaining to be completed.

Suggested Outline for Doctoral Research Proposal

Title Page

Table of Contents

Introduction

Statement of the problem

Importance of the problem

Specific objectives of the project*

Previous Work Related to the Problem

Proposed Research

Theoretical

Experimental#

Data analysis and interpretation

Literature Cited

Nomenclature

Appendices

A. Proposed time-table for the project

B. Equipment needed and estimated costs

C. Anticipated waste-disposal and safety issues

* This section is extremely important. Some clear statement of the objective shall be included in each proposal. It should be noted that the objectives of the research are the goals of the work, in most cases a statement of what will be learned in the study. This is quite different from the approach, which shall be discussed at length in the "Proposed Research" section. The approach describes how the goals will be met.

Some examples of objectives might be:

- To determine the effect of Marangoni convection on mixing of molten glasses.
- To predict the extent of mechanical degradation of polymers.

The approach might be:

- To solve a set of coupled, nonlinear partial differential equations describing...
- To perform experiments on....

It is not essential to include data from preliminary experiments in the proposal

ATTACHMENT 10

University and CSOE requirements for the Master of Science Degree

The Master of Science is a thesis-based degree; each student is required to complete and defend a research-based thesis.

The MS degree requirements defined by the University and modified for the CSOE include:

- 30 Credit hours
(up to 10 credit hours transferred (B or better); this could include distance learning courses taken from other Universities; forms for obtaining transfer credit are available from the Department office)
 - at least 18 credits of graduate coursework
 - 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
- Preparation and oral defense of Master's thesis
- 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

MS Thesis and Defense

Details describing the format and organization of an MS Thesis are available at:

<http://www.clarkson.edu/engineering/pdf/files/MS%20thesis%20procedures.pdf>

The MS Thesis 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. The MS thesis committee consists of at least three Clarkson faculty members approved by the Department and CSOE Dean. Prior to the defense, the committee will select a Chair whose duties are to ensure the smooth conduct of the examination procedure. At the conclusion of the defense and revision of the thesis, the Chair will facilitate completion of the Graduate Student Completion Notice, and will include any special requirements pertaining to the student and/or thesis. There is no limit to the number of times a thesis may be defended, provided the longevity requirement has not been exceeded.

The thesis must be submitted to the committee at least 10 working days before the scheduled defense. To be eligible to receive a degree during commencement exercises in May, final copies

of signed theses must be submitted to the CSOE office no later than 10 working days before graduation.

For theses completed at the beginning of a new semester, the final copies of the thesis must be received in the Graduate School by the last day to complete the new semester check-in process or the student must register and pay tuition for one credit hour of thesis.

Once all corrections have been completed and the committee, departmental and school signatures obtained, two copies of the signed final thesis are to be submitted to the Graduate School for the Graduate Dean's signature. The original will not be signed by the Dean and will not be accepted as a copy. The Department should also receive one copy of the final thesis to be kept in the Departmental library. The departmental thesis copy must be bound in an appropriate manner. The thesis must also be submitted on CD ROM to the CSOE Graduate Coordinator. The CDs should contain two files: (1) the complete thesis (title page through appendices), and (2) the title page and abstract only.

The following completed items are obtained from the Departmental office and are to 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

August 2009

University and CSOE requirements for the PhD Degree

For those interested in an academic or industrial research career, Clarkson's PhD programs in engineering provide an opportunity to pursue leading-edge research and a high degree of specialization. In the CSOE, the minimum requirements for a PhD degree are:

- 90 credit hours minimum (beyond B.S.)
 - Minimum of 24 credit hours of graduate course work
 - Minimum of 15 credit hours in the major field
 - Minimum of 9 credit hours in the minor field
 - Minimum of 6 credit hours from a department other than the one in which the student is housed
 - Minimum of 9 of the course work credit hours taken in residence (may include distance learning classes taken through Clarkson)
 - Minimum of 6 credit hours of seminar.
 - Maximum of 30 credit hours transferred from a Masters degree towards PhD requirements (B grade or better; forms for obtaining transfer credit are available from the Department office)
- ≥ 3.0 cumulative GPA in coursework contributing to degree requirements
- A minimum of three academic years of full time graduate study or the equivalent in part-time study. Two years of study must be in residence at Clarkson University. Students in the external PhD program are exempt from this residency requirement.
- Satisfactory completion of the PhD candidacy procedure within two years after matriculation into the PhD program if a full-time student or before completing 66 credits for part time students
- A written dissertation must be submitted by each candidate and defended orally as part of the final examination
- All work must be completed within 7 years after the student is identified as a PhD candidate
- 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.

Table 1 summarizes the milestones required for the PhD degree, their time limits and forms required to confirm progress through these milestones.

Table 1: CSOE required milestones for the PhD — see departmental handbooks for additional details

Milestone	Approvals required*	Time Limits (after matriculation as a PhD student)	Forms required
Research advisor defined	Faculty Advisor Dept. Chair	By start of second semester	Form A – Graduate Advisor
Preliminary (Qualifying) examination (required for some departments)		Not required by CSOE, see departmental requirements	Only internal departmental form
PhD advisory committee defined	Dept. Chair Dean, CSOE Dean of Graduate School**	Before proposal defense	Form E – Graduate Committee Appointment
Successful completion of Candidacy Examination (defense of PhD research proposal)	Committee members Dept. Grad. Rep. Dept. Chair Dean, CSOE	Within 2 years of matriculation as a PhD student (or 66 credit hours completed for part time students)	Form G – PhD Candidacy Procedure
Dissertation Defense / Approval of final dissertation	Committee Members Dept. Chair Dean, CSOE Dean, Graduate School	At least 1 year after research proposal completed, but within 7 years of candidacy examination.	Form D – Completion Notice Form H – Final degree form - PhD

* or their designee

** only needed if a committee member external to Clarkson is included

PhD Advisory Committee

The research advisor recommends the membership of the PhD Advisory Committee to the Department Chair and the Dean of Engineering for their approval (**Form E**). The committee should be appointed within twelve months after entry into the PhD program. This committee must consist of five members qualified to serve on such a committee, 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 committee members. The purpose of the committee is to provide guidance to the student in the project-related course work and research.

Candidacy Procedure

The intent of the candidacy procedure is to ensure that the student has a solid foundation of knowledge and understanding in the discipline, is capable of pursuing significant independent and original research, and that the scope of the proposed research is appropriate for a PhD degree.

At a minimum, the examination for admission to candidacy must include a written proposal on the student's PhD research and its oral defense before the student's PhD committee. ALL members of the PhD committee must reach a consensus that the student is ready to be admitted to candidacy. The "PhD Candidacy Procedure Completion Form" must be completed with all signatures and submitted to the Department. Departments may choose to also administer a preliminary exam (sometimes called a qualifying exam) as an earlier component of the overall candidacy procedure. Consult the individual graduate handbook for your department for additional details.

- After completion of the candidacy procedure, the students will be identified as a "PhD Candidate."
- Students who fail the first time may make a second attempt within a limited time frame according to Department guidelines. The PhD committee can be reconstituted for the second exam.
- A student who does not successfully complete the candidacy procedure within the time allowed may be dropped from the PhD graduate program.

PhD Dissertation and Defense Policies and Submission Guidelines

Preparation

All PhD dissertations are submitted to ProQuest/UMI[®] Dissertation Publishing and need to be formatted and prepared in a manner that meets their requirements. In addition, Clarkson has specific requirements for the title and signature pages of the dissertation.

Details summarizing the preparation of a PhD dissertation can be found at:

<http://www.clarkson.edu/engineering/pdffiles/PhD%20dissertation%20procedures.pdf>

These procedures should be reviewed carefully. Please note especially:

- General Format: 8.5 x 11 inch paper with 1.5" margins on the left and 1" margins on top, right and bottom. ALL figures, tables, footers, headers etc. must be contained within these margins. Page numbers must be 0.75" from the edge of the page, but do not need to be included within the margins.
- Double space all except the following, which should be single spaced: quotations as paragraphs, captions, items in tables, lists, graphs, footnotes/endnotes, bibliography.

- Black and white preferred (at least for ProQuest); color images will be reproduced as gray scale in microfiche or prints from microfiche.
- Graphics – at least 600 dpi resolution expected.
- Copyright (see also section VII below)–
 - The author of the dissertation must obtain permission to include any material previously published (including your own work) and adequately cite that permission per the copyright owner’s requirements.
 - The dissertation author automatically owns the copyright of materials in the dissertation (or has obtained permission to use the material by current copyright holders). However, registering the author’s claim as the copyright owner with the U.S. Copyright Office would provide the author with greater legal clout should you have any need to contest the copyright ownership. ProQuest/UMI® can complete the required paperwork to register the copyright.
- Open Access publishing - ProQuest/UMI® allows the author to make their dissertation freely available to others through the internet, thereby maximizing its potential dissemination and use. This option should be used only very carefully, however, if the results are also planned for publication as a book or through proceedings or journal papers. In that case, the copyright restrictions imposed by the journal generally do not allow internet publication. The author should check with the journals that he/she expects to publish the manuscripts in prior to choosing this option.
- Embargo – If the author is in the process of patenting or publishing material from the dissertation as journal manuscripts, he/she can select to embargo the dissertation for six months to two years, thereby putting the microfiche or open access dissemination of the dissertation on hold for the embargo period. This allows the author time to submit related patent applications or to finalize manuscript submission and acceptance without infringing on journal copyright requirements.

Defense of the Dissertation

Each graduate student is responsible for working with his/her departmental Graduate Coordinator to make arrangements for a room and advertising the thesis defense at least one week before the scheduled date. Committee members should be provided a period of ten working days to examine the dissertation. Questioning during the defense will ascertain that the student has completed sufficient research work to be worthy of a PhD, that the student understands not only the subject matter to a sufficient depth, but also the broader implications and importance of the research, and that the research is original and was completed independently.

Submitting the PhD Dissertation

Once all corrections have been completed and committee, and departmental signatures obtained, two copies of the dissertation (- not originals) are to be submitted in loose form without holes drilled. The student may place folders around each copy for protection. The Department should also receive one copy of the final dissertation to be kept in the departmental library. The

dissertation must also be submitted on two CD ROMs to the CSOE Graduate Coordinator. The CD should contain two files: (1) the complete dissertation (title page through appendices), and (2) the title page and abstract only. The title page and abstract will be posted on Clarkson's web site.

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 Department Secretary must be submitted to the Graduate School:

- A degree completion notice (**Form D**)
- 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 (**Form H**)
- 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.

Internship or CoOp

The Graduate School may grant permission to a graduate student to participate in a Co-op experience. Eligibility for the Co-op is limited to those graduate students who have matriculated as full time student, have been in residence for at least one semester, and have maintained at least a 3.0 GPA for all graduate coursework. The graduate student's request for permission to participate in the Co-op experience must include (1) a written acknowledgement that she or he has discussed the program with the Career Center counselor; (2) documentation that indicates the Co-op experience is appropriate to the professional and educational objectives of the student, including a statement from the student's graduate program advisor; and (3) a coursework and project/thesis plan that indicates the student's intended path to completing degree requirements. These materials should be routed by the advisor through the department and school for approval.

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