



HAJIM SCHOOL OF ENGINEERING & APPLIED SCIENCES
UNIVERSITY of ROCHESTER

Department of Chemical Engineering

Graduate Handbook

2023-2024

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Online version may differ slightly

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REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY IN CHEMICAL ENGINEERING

The doctoral degree requires a total of 90 credit hours. In practice, most of these are research credits. Note that, during the first year of residence, students are typically asked to take a total of 32 credits. (To maintain the full-time student status, a minimum of 12 credits/semester should be taken.) In addition to research, it is required that entering students **with an MS degree** complete a minimum of 18 credit hours of formal coursework. Those students entering the Ph.D. program **without an MS degree** must complete a minimum of 30 credit hours of formal coursework. Of the formal coursework, four courses must satisfy the “core” fundamentals of Chemical Engineering as defined below.

All incoming Chemical Engineering PhD students will be required to take four core classes in their first year of study:

Mathematics

CHE 400, Applied Boundary Value Problems (Fall) (or petition to take a different math course)*

Transport Phenomena

CHE 441, Advanced Transport Phenomenon (Fall) (or petition to take both ChE 443 & 444)*

Graduate Level Kinetics

CHE 461, Advanced Kinetics and Reactor Design (Spring) (or petition to take ChE 431)*

Thermodynamics

CHE 485, Thermodynamics and Statistical Mechanics (Spring)

*It will be up to the students to determine if they need to petition for a change to a course, and to use the standard Chemical Engineering petition form.

Find courses at: <https://cdcs.ur.rochester.edu/> or in [UR Student](#)

PROGRAM OF STUDY (POS)

The student’s academic advisor assists the student in developing a complete program of study for the anticipated degree. Each program of study course list and all subsequent changes must be approved by the student’s advisor and the associate dean for graduate studies. Students who take courses without the approval of the advisor and the associate dean, or without registering for them, may not receive credit toward their degree requirements.

The Ph.D program of study course list, approved by the department chair, program director, or their representative, should be filed with the department as soon as possible, and will be updated prior to the PhD proposal qualifier exam.

**University of Rochester Department of Chemical Engineering
 Student Program of Study Course List**

Student Name: _____ UR ID _____ MS ___ PhD ___
 Prev. Ins. Prev. Ins.
 Previous Institution _____ Degree _____ Major _____

Subject/ Course #	Course Title	Credits/ Units	Grade
CHE 400	Applied Boundary Value Problems	4.0	A
CHE 441	Advanced Transport Phenomenon	4.0	A
CHE 496	Departmental Seminar	0.0	A
	At least four additional credits during first semester		
CHE 461	Advanced Kinetics and Reactor Design	4.0	
CHE 485	Thermodynamics and Statistical Mechanics	4.0	
CHE 496	Departmental Seminar	0.0	
	At least four additional credits during second semester		
	List remainder of courses. 90 credits of coursework/research		
	Is required for the PhD		

Remarks: _____

Approved: ChE Faculty Advisor: _____ Date: _____

Approved: Dean of Graduate Studies: _____ Date: _____

WAIVING THE CORE COURSE REQUIREMENTS

Students who have taken similar graduate courses elsewhere may in some instances be allowed to waive the core course requirements. Interested students must file a petition for accepting courses taken elsewhere in lieu of the recommended core courses to the Director of Graduate Studies with research advisor's endorsement. Waiving the core course requirements will not eliminate the requirement that students with MS degrees complete 18 credit hours of formal coursework as part of the Ph.D. program of study.

RESEARCH SEMINAR REQUIREMENT

All students are required to register for the Chemical Engineering Departmental Seminar Series (CHE 496), unless they are in-absentia. The department chairperson should be indicated as the instructor for the course with zero credit hours. Grading for this course is based on attendance. Attendance at all the seminars is expected. Students may miss one seminar per semester and still receive a grade of "A". Each additional seminar missed will lower the grade by one letter. The dates and times of the seminars are posted on the departmental web page and announced via e-mail. A sign in sheet will be passed around during the seminar. (For Zoom seminars, the graduate coordinator will monitor attendees.) If you do not sign in, you will not get credit for attendance, so be sure to find the clipboard with the sign in sheet before you leave the seminar. If you attend another department's seminar, please find a way to provide some proof that you attended, perhaps take a picture and email it to the graduate coordinator. The dates and times of the seminars are posted on the departmental web page and announced via e-mail. **If there is a conflict with another class or workshop, the student must email the seminar director (Professor Marc Porosoff) to explain the situation, and copy the graduate director and graduate coordinator. The student must be sure to receive a reply excusing them, and be sure the graduate coordinator has received the reply.**

TEACHING ASSISTANT (TA) REQUIREMENT

<https://www.rochester.edu/college/cetl/graduate/classroom-ta.html>

All PhD students are required to TA two courses. TAs must register for CHE 497-XX, "Teaching Chemical Engineering" with zero credits. Please choose the section number assigned to the instructor you will TA for. Satisfactory performance is required in each TA assignment. Students who fail their TA assignment will be required to TA again. TA training hosted by the graduate dean's office is available in late August, and possibly at some time during the academic year. Please check with your graduate coordinator.

STUDENT RESEARCH PRESENTATION REQUIREMENT:

All PhD students who have completed their qualifying examination will be required to give a presentation of their research to the department.

Ph.D. MAXIMUM TIME OF COMPLETION*

All Ph.D. students admitted to the program are offered graduate fellowships that provide a competitive 12-month stipend and cover the costs of tuition and other fees. Continued support is contingent on maintaining satisfactory academic and research progress, as well as on the availability of funds. The time limit for completion of the PhD is seven years from the date of initial registration. For students entering with a MS degree for which the full 30 credit hours is accepted in the PhD program the time limit for completion of the PhD is six years from the date of initial registration. Any extension of study beyond this time limit requires justification from the student, a recommendation from both the faculty advisor and department chair, and a petition that must be approved by the dean. The extension, if granted, must be limited in duration and reapproved at least annually, following the policies described in latest version of the [Regulations and University Policies Concerning Graduate Studies](#). Students' academic performance is evaluated based on the grades in the formal courses, the performance on the first year PhD exam, and the

attendance of the research seminar. The research performance evaluation is based on the grades in the laboratory research courses, the performance on the second year PhD exam, annual PhD student evaluations, and reports from the dissertation committee meetings.

* All categories including “Leave of Absence” count towards the time limit

Example Elective Courses in Chemical Engineering:
(Class availability and schedule subject to change)

For up-to-date course listings go to
<https://cdcs.ur.rochester.edu/> or
[UR Student Course Sections](#)

CHE 413 Engineering of Soft Matter

CHE 414 Math Meth for Optics & Physics

CHE 431 Chemical Reactor Design

CHE 433 Nano Energy Transport & Conversion

CHE 443 Fluid Dynamics

CHE 444 Heat & Mass Transfer

CHE 454 Interfacial Engineering

CHE 456 Electrochem Eng Fun & App

CHE 458 Electrochemical Engineering & Fuel Cells

CHE 462 Cell & Tissue Engineering

CHE 465 Green Chemical Engineering

CHE 473 Proc Design and Simulation

CHE 468 Fundamentals of Computational Fluid Dynamics

CHE 476 Polymer Chemistry

CHE 477 Advanced Numerical Methods

CHE 486 Polymer Physics

CHE 487 Surface Analysis

QUALIFYING EXAMINATIONS FOR THE PH.D DEGREE IN CHEMICAL ENGINEERING

Philosophy

It is essential that the Ph.D. bound graduate student have a sound technical background and the creativity and judgment necessary to conduct independent research. In addition, it is critical that the student have demonstrated a breadth of knowledge of Chemical Engineering fundamentals before proceeding to specialized Ph.D. research. The purpose of the qualifying examination procedure is to assess these qualities in each student who desires admission to Ph.D. candidacy. The graduate student's competence and promise are evaluated by his/her performance in graduate courses, by a critique of a recently published research article, on thesis research, and by an oral defense of a proposal for Ph.D. thesis research.

Selection of Ph.D. Thesis Advisor

The students are required to formally declare their preferences for at least three Ph.D. thesis advisors by submitting an advisor selection form to the Graduate Program Coordinator before the end of January of their first year of residence. Students should discuss their research interests with the faculty members in the Department and attend faculty research presentations, which are scheduled in September/October. These presentations are 20 – 30 minutes long and give the student an opportunity to ask questions. After the research presentations, it is up to the student to meet with faculty and express an interest in joining that faculty members research group. **Failure to secure an advisor by the appointed time can jeopardize financial support.**

First Year PhD Exam:

The examination is based upon the student's critical evaluation of a recently published research article, which will be given to the student by mid-April. (Subject to change based on situation.) The paper will be outside the student's main research interest. The student must evaluate the paper in a written report and oral presentation. In particular, the student is asked to:

- (a) Identify the fundamental scientific questions addressed by the author
- (b) Formulate a critical appraisal of the author's approach and contribution
- (c) Propose research to extend and improve upon the study presented in the article

The purpose of the exam is to determine student's ability to critically analyze scientific literature and to successfully complete our PhD program. The exam is administered in the first year at the end of the spring semester by the faculty committee.

Students are asked to:

- Submit a **written document** not longer than fifteen double-spaced typewritten pages plus appendices which contain three sections: Questions addressed by the author, critical appraisal of the article and proposal for additional research.
- Give a **20 minute presentation** with slides that overviews and critically analyses the paper.
- Participate in a **discussion** to assess:
 - (a) The student's ability to evaluate published research critically
 - (b) The student's creativity in suggesting new lines of research
 - (c) The strength of the written document with respect to both content and style
 - (d) The student's grasp of Chemical Engineering fundamentals (i.e. transport phenomena, thermodynamics and reaction engineering).

The goal is to evaluate the student's general knowledge, his/her command of the relevant literature and the ability to plan and execute experiments that will test the research hypothesis.

The committee will report their evaluation of the student's performance to the Graduate Committee. In addition, the committee will examine the student's entire record (coursework, research performance, and examination results) and recommend to the department faculty whether the student should be encouraged to proceed toward PhD candidacy. Recommendations of the committee include, among others:

- (a) The student should be regarded as suitable for doctoral work and should proceed accordingly.
- (b) The student should proceed with MS research and might be considered for PhD candidacy after repeating the First-Year Examination.
- (c) The student should be regarded as an MS candidate only and should be encouraged to plan accordingly.

An affirmative decision may include recommendations to the student to address deficiencies such as taking technical courses or taking courses designed to improve written or oral communication skills.

Example of First-Year Examination Scheduling/Timeline

- April 12, 2024: The graduate program coordinator will email three papers for you to choose one that you will use for the written portion of the exam.
- April 19, 2024: Notify graduate program coordinator by email informing the department which paper you selected by noon.
- May 15, 2024: Email written document to graduate program coordinator by noon.
- Examinations: Week of May 20, 2024

Dates subject to change due to unforeseen circumstances

PhD Proposal Exam

The purpose of the exam is to assess student's ability to carry out high-quality research and successfully complete our PhD program. Student must have his/her thesis committee formed, and is responsible for scheduling the exam and reserving a room. This information must be communicated to the graduate coordinator a month in advance. The exam is administered in the 2nd year at the end of the spring semester by the student's PhD committee. Students are asked to:

- Submit a **proposal document** a month in advance that (1) assesses intellectual merit of the research project; (2) summarizes the research hypothesis, project aims and the experimental plan for the entire project, and (3) discuss already collected data and results. The document is limited to 25 pages (double-spaced typewritten pages, excluding reference and experimental details.)
- Give a **30 minute presentation about the proposal document**.
- **Participate in a ~60 minute discussion** with the goal to determine student's general knowledge in the proposed area, his/her command of the relevant literature, and the ability to plan and execute experiments that will test the research hypothesis.

Possible Outcomes of the Proposal Exam:

- Pass
- Pass with contingency that does not require another oral examination.
- Fail with a possibility to retake the exam over the summer or at the beginning of the fall semester.
- Fail with a possibility to complete an MS degree.

After the proposal, PhD students are required to have annual committee meetings, where the students give reports on their progress and the committee makes additional suggestions and recommendations relevant to the research project.

Qualifying Examination (Proposal Exam)

All PhD programs must administer a qualifying examination as part of the PhD program requirements. The qualifying examination may be either written or oral or both, at the discretion of the department/program, and must be passed at least six months before the final examination may be taken. The Committee to conduct a qualifying examination will be chosen by the student and his/her faculty advisor and will consist of at least three full-time faculty of professorial rank (four for the School of Medicine and Dentistry). Subject to the approval of the appropriate Committee on Graduate Studies, each department/ program may designate whether or not it will include a member from another department/program on the committee. If so, at least one current full-time faculty member at assistant professor rank or higher from outside the department in the role of "outside reader." The holder of a secondary appointment in the department offering the candidate's degree program may serve as the outside member, provided that his or her primary appointment is in another department.

A vote to pass the candidate must be approved by a majority of the designated members of the committee. The votes of all committee members will be recorded. The office of the associate dean must be notified at least two weeks before a qualifying examination is to be held, and passage or failure must be reported within one month after the examination. After a failure, a second qualifying examination may be taken if in accordance with program policy. A third examination may be taken only upon the recommendation of the appropriate Committee on Graduate Studies and with the approval of the associate dean or equivalent. In the School of Nursing and the School of Medicine and Dentistry, a third examination will not be given.

THESIS DEFENSE

Consult the GEPA website. The information you need will be found here:

<https://www.rochester.edu/college/gradstudies/phd-defense/index.html>

Registration of Your Thesis for Defense: Will be done online in conjunction with the graduate program coordinator in Sharepoint PhD Process.

Defense Committee: A defense committee should consist of two full-time faculty members from ChE and one full-time faculty member outside ChE. **The outside member cannot be your co-advisor.** See the graduate bulletin for full details.

The formatting specified in the [manual](#) must be strictly adhered to.

The day you upload your defended and corrected thesis to ProQuest is your last day of being considered a student.

PHD SELF-EVALUATIONS

A self-evaluation will done once a year. PhD students should complete the form no later than June 30. (Check with grad coordinator for form.) Students should request a day/date/time to discuss their self-evaluation with their advisor. This discussion should take place by July 15. Your advisor will add comments to the form. You can then respond to any comments made by your advisor by July 22. Your advisor will then forward the form to the graduate director for review. All forms will be sent to the graduate dean's office by August. *Dates subject to change.

CHEMICAL ENGINEERING FELLOWSHIPS

Costich Fellowship: PhD students in chemical engineering are encouraged to apply for the Earl W. Costich Graduate Fellowship, which carries a one-year stipend of about \$1,800. The award, named after a 1942 alumnus of the department, can supplement a student's existing stipend.

INTERNSHIPS

For information on research internships, see the Graduate Education Handbook. It is important to contact the graduate coordinator well in advance of your internship start date. Paperwork cannot begin until a signed offer on letterhead has been received from the company or government laboratory where you will be an intern. If you are an international student, your pre-internship paperwork will require additional Curricular Practical Training approval forms, and review by the International Services Office. Time must be allowed for paperwork to be done, reviewed and approved.

Graduate Education Handbook: <https://www.rochester.edu/college/gradstudies/graduate-handbook/index.html>

<http://www.iso.rochester.edu/employment/students/cpt.html>

REQUIREMENTS FOR THE MASTER OF SCIENCE IN CHEMICAL ENGINEERING

1. BACKGROUND COURSES

Basic Sciences

All students who intend to follow a Master of Science degree program in chemical engineering should have acquired technical background in chemistry, mathematics and physics. Prior coursework should include at least include one full semester course in general chemistry, organic chemistry, physical chemistry, differential equations, and calculus-based Newtonian mechanics (physics). If such courses are absent from a student's undergraduate curriculum, the student must upgrade his/her technical background to at least these minimum standards by taking the necessary courses.

Chemical Engineering

The requisite background in chemical engineering is normally provided by a series of one semester courses in each of the following areas: fundamentals of transport processes, thermodynamics, separation processes and reactor design. These requirements are automatically satisfied by a BS degree in Chemical Engineering. Those graduate students who do not have an undergraduate degree in chemical engineering may satisfy these minimum engineering requirements by taking at least **two additional courses in core areas offered by the department**. Master of Science students who do not have a baccalaureate degree in engineering should normally select all their courses from those offered by the School of Engineering and Applied Science. Background courses in chemistry, mathematics and physics cannot be included as part of the coursework requirement for an advanced degree in chemical engineering.

2. MASTER OF SCIENCE DEGREE PROGRAMS

The Master of Science degree may be earned with or without writing a thesis; the general requirements for the degree are described in the University of Rochester's Graduate Studies Bulletin. Graduate students have the option to complete the MS degree with a **thesis (Plan A)** or coursework-only **non-thesis (Plan B)**. Full time students receiving a stipend must complete a thesis (Plan A) unless the research advisor and the Graduate Committee approve the Plan B program.

Master of Science with Thesis (Plan A)

The MS degree with thesis (Plan A) requires **30 credit hours** of which **at least 18 should be formal coursework** acceptable for graduate credit. The balance of credit hours required for the degree is earned through MS reading and/or research courses (ChE 495). **A minimum of six research credits are required for a Plan A**. Satisfactory completion of the Master's thesis is also required for the degree.

Master of Science without Thesis (Plan B)

Students who pursue the MS degree without thesis (Plan B) must earn a minimum of **32 credits of coursework acceptable for graduate credit**. **At least 18** of these credits should be taken from courses **within the department**. Overall **no more than 6 credits** towards the degree may be earned by research and/or reading courses. The additional courses in the Plan B program (over Plan A) are intended to compensate for the elimination of a thesis as a degree requirement, and they must support a MS in chemical engineering even if offered outside of the department.

All students in Plan B must pass a thirty minute oral exit exam before a committee comprised of at least three Chemical Engineering faculty members. A written report is not required. Two weeks prior to the exam, the M.S. candidate will be provided three recently published papers, one of which he or she must choose to evaluate. Students are not allowed to discuss their chosen manuscript with other students or faculty. The exam begins with the candidate presenting a ten minute oral summary and critique of the chosen manuscript. The presentation should consist of projected slides (e.g. PowerPoint). Slides should introduce the chosen manuscript, demonstrate a solid understanding of relevant physical principles, and offer an evaluation / critique of the manuscript. The examination committee members will then ask questions for approximately twenty minutes to evaluate (i) the student's ability to identify and clearly explain the physical principles upon which the paper is based, (ii) the scientific basis and appropriateness of the student's critique, and (iii) student competency in chemical engineering subjects, particularly those related to completed M.S. coursework.

It is considered important that the total exam time (30 minutes for each student) be rigorously maintained. As a result, students are reminded that it is very important for them to use their time well during both the presentation and question portions of the exam. Students are encouraged to rehearse their presentations and will be stopped after ten minutes.

Following the exam, the committee will recommend to the Director of Graduate Studies that the student pass, pass with contingency, or fail. Possible Outcomes:

- *pass*
- *contingent pass*: either take additional course(s) or write a follow-up document to be reviewed and voted on by the committee
- *failure*: can retake the exam the next time it is offered. Students who fail the exam twice are terminated from the program.

The oral exams will normally be held twice a year, after spring break and after fall break. Exams will normally be held in a single block, with students following each other at half-hour intervals.

Timing is subject to change depending on current circumstances.

NOTE: For both the Plan A and B degree options, all courses must be at the 400 level or above and 18 must be courses taken from within the department. The formal courses must also include four "core" chemical engineering courses as described below.

All incoming Chemical Engineering MS students will be required to take four core classes:

Mathematics

CHE 400, Applied Boundary Value Problems (Fall) (or petition to take a different math course)*

Transport Phenomena

CHE 441, Advanced Transport Phenomenon (Fall) (or petition to take both ChE 443 & 444)*

Graduate Level Kinetics

CHE 461, Advanced Kinetics and Reactor Design (Spring) (or petition to take ChE 431)*

Thermodynamics

CHE 485, Thermodynamics and Statistical Mechanics (Spring)

*It will be up to the students to determine if they need to petition for a change to a course, and to use the standard Chemical Engineering petition form. Find courses at: <https://cdcs.ur.rochester.edu/> or [UR Student Course Sections](#)

See page six for a list of ChE course electives.

3. PROGRAM OF STUDY

A faculty advisor will generally be named for each Master's student by the end of the first semester. The advisor assists the student in developing a complete program of study for the anticipated degree. Each program and all subsequent changes must be approved by the student's advisor and the associate dean for graduate studies. Students who take courses without the approval of the advisor and the associate dean, or without registering for them, may not receive credit toward their degree requirements. Master's degree programs must be filed no later than the date specified by the college, generally the beginning of the second semester. It is important that students keep a copy of their program of study form, as it will need to be updated every semester with grades received for each course.

**University of Rochester Department of Chemical Engineering
 Student Program of Study Course List**

Student Name: _____ **UR ID** _____ **MS** ____ **PhD** ____

Prev. Ins. _____ **Prev. Ins.** _____

Previous Institution _____ **Degree** _____ **Major** _____

Subject/ Course #	Course Title	Credits/ Units	Grade
CHE 400	Applied Boundary Value Problems	4.0	A
CHE 441	Advanced Transport Phenomenon	4.0	A
CHE 496	Departmental Seminar	0.0	A
	At least four additional credits during first semester		
CHE 461	Advanced Kinetics and Reactor Design	4.0	
CHE 485	Thermodynamics and Statistical Mechanics	4.0	
CHE 496	Departmental Seminar	0.0	
	At least four additional credits during second semester		
	List remainder of courses. 30 - 32 credits of coursework/		
	Research is required for the MS degree		

Remarks: _____

Approved: Student Advisor: _____ **Date:** _____

Approved: Dean of Graduate Studies: _____ **Date:** _____

4. SEMINAR REQUIREMENT

All students are required to register for the Chemical Engineering Departmental Seminar Series (CHE 496), unless they are in-absentia. The department chairperson should be indicated as the instructor for the course with zero credit hours. Grading for this course is based on attendance. Attendance at all the seminars is expected. Students may miss one seminar per semester and still receive a grade of "A". Each additional seminar missed will lower the grade by one letter. The dates and times of the seminars are posted on the departmental web page and announced via e-mail. A sign in sheet will be passed around during the seminar. (For Zoom seminars, the graduate coordinator will monitor attendees.) If you do not sign in, you will not get credit for attendance, so be sure to find the clipboard with the sign in sheet before you leave the seminar. If you attend another department's seminar, provide some proof that you attended. The dates and times of the seminars are posted on the departmental web page and announced via e-mail. **If there is a conflict with another class or workshop, the student must email the chair of the department to explain the situation, and copy the graduate director and graduate coordinator. The student must be sure to receive a reply from the chair excusing the student, and be sure the graduate coordinator has received the reply.**

5. TEACHING ASSISTANT (TA) REQUIREMENT

<https://www.rochester.edu/college/cetl/graduate/classroom-ta.html>

As part of the educational experience, all MS students are required to TA at least once. TAs must register for CHE 497-XX, "Teaching Chemical Engineering" with zero credits. Please choose the section number assigned to the instructor you will TA for. Satisfactory performance is required in each TA assignment. Students who fail their TA assignment will be required to TA again. TA training hosted by the graduate dean's office is available in late August, and possibly at some time during the academic year. Please check with your graduate coordinator.

6. MS DEGREE MAXIMUM TIME OF COMPLETION*

A candidate must complete all the requirements for the master's degree within **five years** from the time of initial registration for graduate study, and must maintain continuous enrollment for each term after matriculation. Students who for good reason have been unable to complete a program within five years may, upon recommendation by the faculty advisor and department chair, petition the associate dean for an extension of time. Such extension, if granted, will be of limited duration. * All categories including "Leave of Absence" count towards the time limit

REQUIREMENTS FOR THE THESIS PROPOSAL FOR MASTER'S FUNDING

Proposal Description:

The thesis proposal serves two primary purposes. First, it is the means by which the funding committee evaluates the merit of the research. The objective of the Master's funding program is to support research experiences for our students wanting to pursue Plan A degrees, while seeding new research directions within the laboratories of departmental faculty. Our department emphasizes original, innovative, high impact research on important applied and scientific problems. The proposal should present your proposed approach to a problem or open question – demonstrating your technical acumen and convincing the committee of the likelihood of its success. Second, the proposal is used to judge your writing abilities. A Plan A Master's degree requires that you conduct original research, and then prepare and defend a dissertation to be read and evaluated by a thesis committee. From UR's *Preparing Your Thesis* manual (<http://www.rochester.edu/Theses/ThesesManual.pdf>), "At the University of Rochester, the doctoral [also master's] thesis is expected to be an original work by the student, formulated in a scholarly manner and with content of a quality consistent with respected publications in your field." This statement is not intended to dissuade you from pursuing a Plan A degree but rather emphasize the importance of strong writing skills required to produce a high quality, defensible thesis.

The thesis proposal should describe the research topic, impress the scientific interest or practical utility of the topic, review the current status in the field and previous results from your advisor's laboratory, and describe your proposed approach to an important question or problem.

Proposal Instructions:

The proposal must be prepared solely by you. You are encouraged to seek assistance from friends and the UR Writing Center (writing.rochester.edu), but the text and ideas must be developed by you independently. Do not copy text from other sources, including materials that your perspective advisor might provide you.

The written reports should be no more than 1600 words in length (the cover page, figure captions, references, and budget justification are excluded from the word count). The report should contain enough information that an outside reviewer with a technical background but who is not an expert in the field can fully understand and critique it. The formatting and the technical content of the proposal is left to your discretion, but it should be a highly polished document written at a technical level. Feel free to discuss the content of the proposal with your advisor, but some examples and suggestions are provided below:

- *Introduction and Background:* Describe the research topic. Why is it important? What is its technological relevance or what fundamental property/phenomenon do you expect to uncover?
- *Previous work:* What has been achieved? What are recent breakthroughs? What contributions has your advisor's lab made and how is your research distinct?

- *Proposed work*: Thoroughly describe your idea – specifically, what experiments do you intend to do. Justify your proposed approach.
- *Conclusion*: Briefly summarize the main points.
- *References: (required)*
 - Must be cited in the body of the text
 - Should come from high quality, reliable sources - often peer-reviewed publications and/or books
 - A consistent formatting of the references and in-text citations should follow the general practice of your discipline, but the ACS Style Guide is a good starting point:
<http://pubs.acs.org/isbn/9780841239999>
Example: Stark, T.; Potts, P. The Body Weight Distribution of Mutants at Xavier's School for Gifted Youngsters. *Journal of Obscure Data* **2014**, *20*, 200-215.
- *Figures (required)*
 - Should be embedded throughout main body of the text (not listed at the end)
 - At least some should be original figures that you have prepared (not reproduced from references)
 - If you do reproduce a figure, it should be cited appropriately.
- *Appendix, Budget Justification (limited to 1 page)*
 - Maximum allowable budget is \$5000
 - With input from your PI, describe and justify the requested budget.
 - *A table categorizing the various expenses is an effective way to present the budget, but concise justification of each line is required.*
 - Examples of allowed costs: small equipment, chemicals, supplies & consumables, user facility instrument fees, conference registration fees, specialized software, etc.
 - Unallowed costs: salaries, equipment maintenance & service contracts, new computers & office equipment for your advisor's group

Document formatting (do not deviate)

- 8-1/2 x 11" paper
- 1" margins on all sides
- Font: 11 pt., Times New Roman or Arial. Other fonts are not allowed.

MASTER'S THESIS REGISTRATION INSTRUCTIONS

- Plan ahead: Contact graduate program coordinator at least 4 weeks prior.
- Thesis must be registered at least 10 full working days prior to defense date. Earlier is better!
- All paper work must be completed BEFORE those 10 days.(See #1)
- Program of study must be completed.
- Student must have completed or will have completed 30 hours of study by the anticipated graduation day.
- Student coordinates committee members prior to thesis registration. Committee must consist of the following faculty members:
 - Two full-time (assistant professor or higher) from within ChE°
 - One non-department full-time (assistant professor or higher)
 - If non-department student advisor, need additional committee member from within ChE°
- Student needs to contact graduate program coordinator to reserve room for defense.
- Thesis registration:
 - Examination Appointment Form must be completed
 - One bound copy of the thesis must be registered with the Graduate Students Office (218 Lattimore) at least 10 working days prior to defense date along with Examination Appointment Form.
- Student needs to provide and deliver a copy of their thesis to each committee member. This is done the same day the thesis is registered.
- Student needs to provide graduate program coordinator with the abstract & title of their thesis. This is done the same day the thesis is registered
- Master's defense guidelines:
- <http://www.rochester.edu/college/gradstudies/masters-defense/before.html#writing-guidelines>
You may obtain a copy of the UR Theses Manual online:
<http://www.rochester.edu/theses/ThesesManual.pdf>

After your defense and any corrections are made to the thesis, two final unbound copies are delivered to Grad Studies. One unbound copy and one on e-copy are provided to graduate program coordinator.
<http://www.rochester.edu/college/gradstudies/current/>

LABORATORY SAFETY

Please see last page for interactive power point slides

VACATION & TRAVEL

Graduate students should be on campus doing research during academic breaks and are expected to do research throughout the year. Graduate students are entitled to two weeks of vacation each year in addition to official University Holidays. University holidays include Christmas Day, New Year's Day, Martin Luther King Day, Memorial Day, Juneteenth, the 4th of July, Labor Day, and 2 days at Thanksgiving. While the scheduling of vacations is left to the discretion of the student, prior approval from the advisor must be obtained so as not to conflict with coursework, laboratory experiments and other duties.

Before scheduling an extended absence from the University (i.e., more than 10 business days), students must obtain permission from their thesis advisor and the ChE Program Director. It is extremely important that ALL international students contact ISO to get their recommendations for international travel (including Canada) at least 10 days in advance.

MORE INFORMATION FOR GRADUATE STUDENTS

GRADUATE COMMITTEE:

The graduate committee is comprised of the graduate director, two additional faculty and the graduate program coordinator. The graduate committee meets regularly and makes decisions regarding graduate admissions, graduate activities, graduate requirements and course review. The graduate committee can put students on probation and separate students from the program. Appeals to any such decisions can be made to the Dean of Graduate Education and Postdoctoral Affairs.

CREDENTIALS

Each entering student must eventually provide all documents requested in the application form (even when an offer is made prior to receipt of all such documents). These include supplementary or final transcript, including certification of the completion of any degrees (by date TBA, or a hold will be put on your ability to register for classes) & Health History Form. Graduate admission is, in addition, contingent upon completion of the requirements for a Bachelor's degree, or equivalent, unless an exception is explicitly noted in the letter of appointment.

IMPORTANT: All students receiving assistantships from the University to submit proof of their employment eligibility. Failure to complete an Employment Eligibility Verification (Form I-9) will result in termination of an assistantship.

Documents that establish both identity and employment eligibility are (a) a US passport, (b) a certificate of US citizenship, (c) a certificate of naturalization, (d) an unexpired foreign passport with attached employment authorization or (e) an alien registration card with photograph. –OR–

You can prove your identity by providing a US Military Card, a state-issued driver's license, or a state-issued ID card with a photograph that includes your name, sex, date of birth, height, weight, and color of eyes. You can establish employment eligibility by producing either an original Social Security number card (other than a card stating it is not valid for employment), a birth certificate issued by a state, country, or municipal authority bearing a seal or other certification, or by an unexpired USCIS Employment Authorization

Please follow the instructions here: <https://www.rochester.edu/human-resources/i9-and-e-verify-information/>

TAX INFORMATION FOR INTERNATIONAL STUDENTS:

<https://iso.rochester.edu/taxes/index.html>

SOCIAL SECURITY AND INTERNATIONAL TAX ID NUMBERS:

<https://iso.rochester.edu/employment/ssn/index.html>

REGISTRATION

All students must register for at least twelve credit hours in order to be considered full-time. Students who will be a teaching assistant for that semester may register for nine credits. Registration must be completed within two weeks from the first day of classes or a late registration fee will be charged (\$160.00). Registration is online through UR Student. <https://tech.rochester.edu/ur-student-training/>

DROPPED COURSES

A regular semester course may be dropped at any time through the sixth week of classes, provided the student obtains the approval of his or her faculty advisor and the instructor(s), notifies the graduate registrar on the proper drop/add form, and the change does not alter the student's time status. No record of such actions appears on the official transcript.

In exceptional circumstances, the associate dean of graduate studies will review the circumstances as initiated by an appropriate written petition.

EXTERNAL WORK POLICY

Full-time students holding fellowships, assistantships, or scholarships may not accept other full-time employment.

FINANCIAL AID

Please contact the Financial Aid Office at (800) 881-8234 or visit the website at <http://enrollment.rochester.edu/financial/> for additional details on loans and contact information for staff members.

UNIVERSITY OF ROCHESTER STUDENT HEALTH PROGRAM

<http://www.rochester.edu/uhs/>

Click this link for information on immunizations, the Mandatory Health Fee, Student Health Insurance and other University Health Services issues.

ACADEMIC HONESTY POLICY

<https://www.rochester.edu/college/honesty/policy/index.html>

It is **essential** that student familiarize themselves with the *strictly enforced* University Academic Honesty Policy.

Need more information? Check these Important links:

Payroll:

<http://www.rochester.edu/payroll/wp-content/uploads/2020/12/Self-Service-User-Guide.pdf>

Find information on Direct Deposit, W-2 forms, etc.

Graduate Handbook:

<https://www.rochester.edu/college/gradstudies/graduate-handbook//index.html>

Graduate Calendar, Academics, Registration, Grading, Transferring Credits, Family Policies, Conduct, Finance and Campus Resources.

For Incoming Students:

<http://www.rochester.edu/college/gradstudies/incoming/index.html>

Overview, Required Pre-enrollment Documentation, Orientation, Checklist, Registration, Graduate Housing & Dining, Student Health Program, University Resources, Financial Information, International Students

For Current Students:

<http://www.rochester.edu/college/gradstudies/current/index.html>

Overview, Registration, Dissertation Committees, PhD Defense, Master's Defense, Outstanding Dissertation Awards, Student Support, Forms and Policies, Professional Development, Resources

International Students:

<http://iso.rochester.edu/index.html>

Graduate Studies Bulletin:

<https://www.rochester.edu/graduate-education/academic-resources/>

Laboratory Safety

Clair Cunningham
Department of Chemical Engineering

James Stair
Environmental Health and Safety



Slide1

Everyone has a Role:

- Principal Investigators
- Laboratory Employees and Staff
- Students
- Environmental Health and Safety
- Deans and Chairs of the Department




Slide2

Why Safety Matters:



- You matter**
 - To yourself
 - To your family
 - To your friends
 - To this University
- Individuals need to protect themselves, and watch out for others.
- Federal, State, and Local Laws mandate and control hazards in the workplace, including Laboratories.




Slide3

Common Dangers in the Laboratory



Chemicals	Physical Hazards
<ul style="list-style-type: none"> Flammables Toxics Corrosives Carcinogens/Mutagens Pyrophoric 	<ul style="list-style-type: none"> Compressed Gasses Sharps (razor blades, needles, broken glass) Cryogenics Pressurized/Vacuum systems Electrical wires/cords Hot or Cold Environments

Slide4

How do **You** intend to stay safe in the laboratory?

- By asking questions
- Wearing PPE at all times
- Being dressed properly
- Not working alone
- Working in a fume hood or glovebox
- Asking for help
- Knowing what other people/experiments are occurring in the laboratory

Slide5

Training


- Laboratory Safety Training is required annually.**
 - As graduate students you will **not** have it as employees.
 - https://www.ehs.rochester.edu/ehs/index.php?option=com_content&view=article&id=104&Itemid=104
 - A copy of the training transcript should be sent to your PI before any work is done in the lab.
 - Five available EH&S trainings: (Consult your Principal Investigator (PI))
 - EH&S Laboratory Safety Training Standard Chemical 2023
 - EH&S Laboratory Safety Training Chemical and Biological 2023
 - EH&S Laboratory Safety Training Chemical and Animal 2023
 - EH&S Laboratory Safety Training Chemical/Biological/Normal 2023
 - EH&S Laser Safety Training (Class 3B or 4 Lasers)



Slide6

Training



- Additional training may be required by your lab, consult your PI.
 - EH&S Hydrofluoric Acid Awareness 2023
 - EH&S Fire Extinguisher Training 2023
 - EH&S Electrical Safety 2023
 - EH&S Fundamentals of Radiation Safety for RAM Labs 2023



Slide7

Best Practices with PPE

- Wear your Personal Protective Equipment (PPE) at all times.
- All PPE has limitations: be sure you know the limitations of the safety equipment you are wearing.
- Do not touch personal property with gloves on:
 - Cell phones, water bottles, computers, etc.
- Do not touch public surfaces with gloves.
 - Door knobs/handles, elevator buttons, drinking fountains, etc.
- Wear gloves in the hallway, single glove if necessary






Slide8

Fume Hoods

Ensure fume hood sash is at or below the working height (around 18 inches) at all times.


- Never stick any part of your body, other than your hands, within the fume hood.
- Work at least 6 inches back from the front of the ledge to ensure complete capture of vapors.
- Keep your fume hoods clean and tidy.
- Do not ignore fume hood alarms.
- Notify your PI, call Facilities x3-4567

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Fume Hood or Utility Problems

- Call Facilities at (585) 273-4567
- Give the Location, Building, Floor, Room Number
 - Ex: River Campus, Gavett Hall, 1st Floor, Gavett 119
- Give a concise description of the problem.
- Provide your name, phone number, and confirm the email they can send the work request to.



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In Case of Emergency

First Call Public Safety:

(585) 275-3333


x5-3333 from a University Landline Phone




Slide11

In Case of Emergency


- Contact your PI
- An employee incident/injury form must be completed within 24 hours of sustaining an injury or having an emergency within the laboratory.
 - <http://www.safety.rochester.edu/SM1115.html>
- Evacuate, if necessary



Slide12

Evacuation of Laboratory

Evaluate the situation. Know your laboratory's emergency procedures and how to shut down your experiment or surrounding experiments so that the situation does not escalate.



Slide13

Lacerations or Cuts

- If you are hurt or injured with a sharp:
 - Flush the affected area for 15 minutes with water
 - Notify your supervisor of your injury
 - Seek medical attention if necessary, through University Health Service or Strong Memorial Hospital Emergency Department
 - Fill out an [Employee Incident Form](#) within 24 Hours of your injury




Slide14

University Health Service

Phone: 585-275-2662
2nd Floor, UHS Building
738 Library Road, River Campus

Hours during the academic year:

- Monday-Thursday, Tuesday-Friday: 8am to 5pm
- Tuesday: 8am to 5pm
- Saturday: 10am to 5pm (staff on call)

Summer Hours:



- Monday-Thursday, Tuesday and Friday: 8am to 5pm
- Tuesday: 8am to 5pm
- On the summer, the office closes at 6:00 on Fridays




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Strong Memorial Emergency Room

- For any injury requiring more than simple first aid of cuts or injuries:
 - Stitches
 - Burns
 - Serious sprains or broken bones (X-Rays)
- Depending on severity, transportation can be provided by personal vehicle, Public Safety, or Ambulance.

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Spills

Spills are classified as either **Minor** spills or **Major** spills depending upon the following evaluations:

- The amount, location, volatility, flammability, and overall hazard classification of the material.
- The number of trained people available to help in the clean up.

In dealing with spills:


- Seek technical support from the SDS, your supervisor, and/or EH&S's Laboratory Safety Unit.
- Inform your fellow lab workers.
- If it's a dry chemical, keep it dry (sweep up).
- If wet, use an absorbent or spill kit.
- All spill cleanup should be properly wasted.



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Spills

- If a spill poses a health or safety threat, or it can't be cleaned up quickly by trained personnel, call Public Safety from any phone at **(585) 275-3333** or x13 on any landline.
- Public Safety will contact EH&S's Spill Response Team.



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Fires

R Rescue / Relocate

- Anyone in immediate danger

A Alarm / Alert

- Activates pull station, call Public Safety x13

C Close door/Confine fire

- Keep smoke in the location, helps prevent the spread of fire

E Evacuate / Extinguish

- Follow fire exit signs and leave the building. Do not reenter until cleared to do so.
- Extinguish only if you have been trained, are willing, able, the fire is small and in the initial stage




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Fires

- In addition to using **R.A.C.E.**:
 - Know how to shut-down or control your experiments.
 - Know what other experiments or materials are in the area.

Note: Housekeeping and minimizing clutter and materials on laboratory benches, fume hoods, and floors greatly reduces chance of escalation in the event of an accident or injury.




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Hazardous Waste

- All containers must be labeled with Hazardous Waste and in secondary containment. The concentrations and the amount must be listed on the bottle.

Acceptable nomenclature:

- Chemical Names only
- Ex:
 - 500 mL Acetonitrile
 - 20 mg Arsenic
 - 100 mL Water
 - 500 mL 50% Methanol 50% Water



Labels need to be readable and each item listed will need to be entered into Chemstar for waste pickup. Free Pickup available every Thursday.



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Gas and Liquid Cylinders



- Transport all gas cylinders and liquid cylinders using the appropriate cart
- Gas cylinders should be capped when not in use, during transport, and/or before removing straps/chains

Slide22

Gas and Liquid Cylinders


- See your PI for lab specific procedures about moving cylinders.
- All cylinders should be secured when they are in use, not in use, or transported.

Slide23

Lab Cleanliness/Housekeeping


- All disposable items should be disposed of into their proper containers whenever work has finished.
 - Paper towels, sharps, etc.
- Gloves should be disposed of after each use and never worn outside of the lab or taken off and reused. Refer to EH&S safety training for details and exceptions.
- Keep the area in front of electrical cabinets clean.
- Don't store things on top of flammable cabinets.
- Do not block walkways, chairs should be stored out of the way.
- Eye wash stations should be accessible and the area kept clean.
- Store objects in the hallway.



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Chematrix


- For access, please make sure your UoR account is active.
- The PI or lab manager can add new members once their account is active.
- All members can enter chemicals in the system.
- All material safety data sheets are available after login
- http://www.safety.rochester.edu/labsafety/chematrix/chematrix_intro.html
- Annual Chematrix inventory reconciliation is required, emails will be sent out to remind PIs.




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Chematrix Training and Help


- EH&S offers Chematrix help sessions every Wednesday. The link is available on the website.
 - <https://www.safety.rochester.edu/labsafety/chematrix/chematrixhelp.pdf>
- If errors or problems occur, email: Chematrix_Support@safety.rochester.edu or contact Abby Davis or James Stair at EH&S



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Best Practices 

- Do not work alone.
- Know your surroundings.
- Be aware of what others are doing around you!
- **Keep your cell phone at your desk, in your bag.**
- **No food or drinks in the lab.**
- Ask questions:
 - If you are unsure about a chemical, procedure, or equipment, **ask somebody!**
- Only conduct research and experiments that you have been trained on and feel comfortable performing.




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Contacts for Help with Lab Safety

- The PI
- The lab members
- EH&S
 - Laboratory Safety (585) 275-2243
 - Corinne Hare (Laboratory Safety Manager)
 - James Stair (Laboratory Safety Specialist)
 - Chematrix Help – Abby Davis
- Jeffrey Lefler
 - (585) 275-4047
- Clair Cunningham
 - (585) 275-4922




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Resources 

Chematrix Help:
http://www.safety.rochester.edu/labsafety/chematrix/chematrix_intro.html

Safety Data Sheets:
<https://www.rochester.chematrix.com/Chematrix/>

Safety Resources:
<http://www.safety.rochester.edu/labsafety/subjectindex.html>



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