

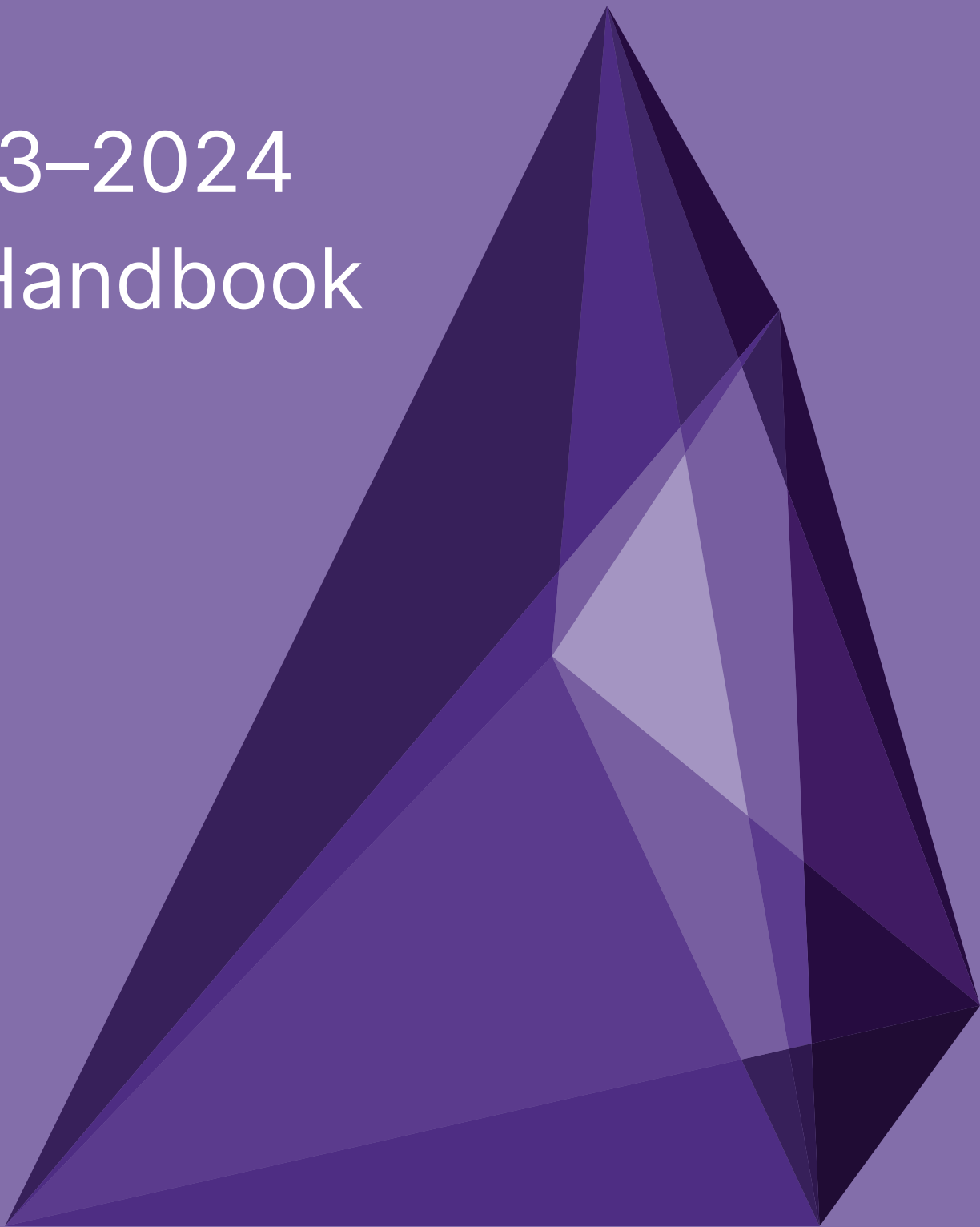
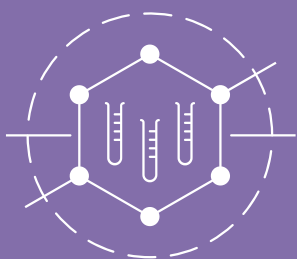
Northwestern

McCORMICK SCHOOL OF
ENGINEERING

Chemical and
Biological Engineering

2023–2024

PhD Handbook



Program in Chemical and Biological Engineering

PhD Handbook

Version: September 2023

DISCLAIMER: The program in Chemical and Biological Engineering reserves the right to change without notice any statement in this publication concerning, but not limited to, rules, policies, curricula, and courses.

STRUCTURE OF THIS DOCUMENT

1. Introduction	3
2. Program Milestones	
a. Summary and Timeline	4
b. Finding an advisor	5
c. Coursework curriculum	7
d. Continuation decision	7
e. Annual Review	8
f. Proposal (Qualifying Exam and PhD Prospectus)	8
g. 4 th year review	10
h. Dissertation and Program completion	10
3. Curriculum	
a. Distribution of courses	12
b. Other program activities listed with the registrar	13
c. Entering with prior graduate coursework	13
d. Entering with non-ChemE degrees	14
e. Language proficiency	15
4. Key program policies	
a. Teaching	16
b. Transfer into and out of the program	17
c. Finances	17
d. Vacation time and Leaves	17
e. Fellowships, Internships and Professional Development	18
f. Conflict of Interest and Commitment	19
5. Academic Affairs	
a. Standing and Probation	21
b. Exclusion and Appeals	21
c. Improper conduct	22

SECTION 1. INTRODUCTION

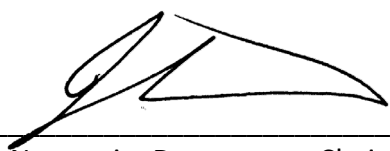
Welcome to the PhD program in Chemical and Biological Engineering. This will be your home for the next five years or so, and we hope it will be a successful, intellectually engaging, and fulfilling experience.

The policies described in this handbook and the policies of the University and The Graduate School (TGS) set the official guidelines for completion of milestones in this program. In addition to reading and understanding this document, it is your responsibility to familiarize yourself with TGS and University policies that also apply. Separate, unofficial, documents are maintained by the Department's graduate student organizations and provide helpful hints on navigating town and gown life, common Department actions, teaching duties, and other similar topics. TGS maintains a useful New Student Guide, which can be found on their website.

A note on terminology before we go further: you are entering as a *pre-candidacy* graduate student in the *program* of Chemical Engineering. Most of the faculty in the program are members of the *Department* of Chemical and Biological Engineering, which runs the courses and is a part of the McCormick School of Engineering and Applied Science (McCormick). However, your program is administered by The Graduate School (TGS). You will eventually pass your proposal, which for us counts as both your qualifying exam and your PhD prospectus, and only then will be a *PhD candidate*. Finally, after your dissertation defense, you will get a *PhD degree* in Chemical Engineering.

For any questions on lab, program, or TGS policies, never hesitate to ask your research advisor, the Department chair, the graduate program assistant, or the Director of Graduate Studies (DGS). Please make yourself familiar with the Department homepage, especially to learn about the duties of the Department staff and how they can help you.

Welcome to the program and good luck!

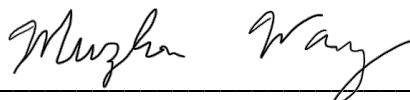


Justin Notestein, Department Chair

ChBE-Chair@northwestern.edu



Keith Tyo, co-Director of Graduate Studies



Muzhou Wang, co-Director of Graduate Studies

ChBE-DGS@northwestern.edu

SECTION 2. PROGRAM MILESTONES

SECTION 2a. SUMMARY AND TIMELINE

There are four key milestones set by the program:

- 1st quarter: Advisor selection
- 8th -9th quarter: Selection of committee and defense of proposal
- 14-15th quarter: 4th year review
- 18th quarter: Departmental seminar

Additional program milestones with somewhat flexible dates are:

- Continuation decision – typically before 5th quarter
- Required coursework – before defense of proposal, but majority complete before Continuation
- Annual Review – completed via GSTS before the start of each new academic year
- TA requirement – typically completed before end of 4th year
- PhD Dissertation and Defense – typically completed before end of 5th year

The rest of this document describes each milestone in detail, and Figure 1 gives the approximate timeline for completion. Failing to meet any of these milestones may result in the student being placed on Academic Probation, which will ultimately result in Exclusion from the program if not remedied.

	Fall	Winter	Spring	Summer
Year 1	Apply for external funding* Choose advisor	Introduction to research	Apply for training grants*	Begin full-time research Annual review
Year 2	Complete courses Continuation decision		Apply for training grants*	Select thesis committee Annual review
Year 3	Defend proposal (start 'candidacy')	Seek external publications and presentations		Annual review
Year 4		4 th year review	Apply for final year fellowships*	Prepare resume and look for jobs Annual review
Year 5	Apply for jobs	Departmental Seminar	Defend thesis	

Figure 1. Timeline for completion of PhD program. Primary activities in a quarter are: program-based (blue), course-based (green), laboratory-based (orange). *optional, but highly encouraged.

SECTION 2b. ADVISOR SELECTION

OVERVIEW

One of the most important milestones of a student's first year is the selection of a thesis advisor. The advisor is responsible for helping a student develop an academic plan, identify a research project, and develop a research plan. The advisor is also primarily responsible for funding a student's studies, and one's advisor can play a significant role in helping a student find the best possible career options following completion of the degree.

To help students choose advisors wisely, the program organizes a series of presentations by core and courtesy faculty who have projects to offer that year. In some years, members of other programs may be invited to give presentations as well. All students are required to attend the presentations. A list of core, courtesy, and invited faculty will be provided each year. Core and courtesy faculty members are listed on the Department website. Some projects may be part of a larger center or structured as a co-advising relationship.

As students identify interesting research projects, **it is their responsibility to meet with the professor** (or professors), interact with the other students, attend group meetings, and otherwise get to know the lab. Students are encouraged to look broadly at all projects on offer. Being actively engaged in the process will help in finding a good home for the next five years and ensure that students are known well by the professors and their lab when it comes time for advisor selection.

Throughout the quarter, the Director of Graduate Studies (DGS) will ask to be updated on progress towards finding an advisor. The DGS will work with the students and expects that the students work amongst themselves, to make the advisor selection process as easy and transparent as possible. By the end of the Fall quarter, students will be asked for a final ranked list of at least three (3) potential advisors or co-advisors. The DGS will compile the selections from all graduate students, and the Department faculty will match them to open positions in the labs. Every effort will be made to assign students to their top choices but remember that a successful match also requires the advisor to want – and to be able – to support the student.

The program aims to finalize advisor assignments by mid-December but will continue to work with individual students to place them with an advisor before the start of the Winter quarter. Since choosing an advisor is so important, students will have the full support of the DGS throughout this process.

NO COMMITMENT POLICY

It is the policy of the program that professors will not formally commit to supporting a student until final assignments are made by the DGS. Likewise, students are not committed to joining any given professor's laboratory until final assignments are made. This policy is maintained regardless of any prior relationship between the professor and prospective advisee.

CO-ADVISING and WORKING with PROFESSORS OUTSIDE the PROGRAM

All core and courtesy members of the Department of Chemical Engineering may advise PhD students without special arrangements. See the Department website for a current roster. In contrast, unaffiliated faculty should generally not be considered during advisor selection, unless they have been specifically invited to participate in graduate student recruiting that year or such an interest has been brought up directly with the DGS.

Many students find co-advised projects to be of interest, and it is a strength at Northwestern. Most typically, a collaboration is already in place, but strong student interest in having a co-advisor can also lead to new collaborations. Co-advising between core and unaffiliated faculty members is also possible. When interested in co-advising, **make sure that all parties are aware and supportive of the co-advising arrangement proposed.**

ROTATIONS

All students participate in two short rotations in the first quarter, organized in cooperation with the DGS. This ensures that each student gets to know at least two possible labs and advisors. Students are expected to be fully engaged with their host lab during each rotation, and they are also highly encouraged to meet with and get to know other groups as well. During a rotation, a student generally will shadow lab members and participate in group meetings. Other activities are at the discretion of the professor. Every effort will be made to match students with their desired labs for rotations, but given the time constraints, no guarantees can be made. Rotating in a lab is neither a guarantee nor an obligation to join that lab.

FAILURE to FIND an ADVISOR

Advisor assignment is the first key milestone. In the rare instances where a student is not able to match with a research advisor before the end of the first quarter, the student will be placed on Probation. If an advisor continues to not be found, the student may be Excluded at the end of the third quarter, as this constitutes a lack of 'satisfactory academic progress,' per TGS policy. If the student has completed the necessary course requirements and maintained an adequate GPA, they may be awarded a coursework-based master's degree at that time.

CHANGING an ADVISOR

If a student finds they are not able to continue working with the advisor they are assigned, they are first encouraged to discuss possible changes in research direction with their advisor. They are then advised to talk with the DGS or the Department Chair as soon as possible to identify possible remedies, including a change of advisor or exiting the program.

SECTION 2c. CURRICULUM

The typical PhD student is required to complete four (4) core courses in thermodynamics, kinetics, and transport, two (2) Department electives, two (2) technical electives outside the Department, and two (2) technical electives of their choice. The typical student should complete at least nine (9) courses the first year.

The following are also required: four (4) quarters of Department seminar attendance, participation in responsible conduct of research (RCR) training, and a professional skills seminar series. These should be completed at the first offering. Finally, four (4) quarters of teaching are required. In your first eight (8) quarters, you will register for a total of 3.0 to 4.0 credits for each quarter through a mixture of coursework, seminars and other requirements, and research (CHEM ENG 590). In later quarters, a special TGS course, TGS 500, is designated. You must ensure that you are always a registered, full-time student.

All of these requirements have course numbers assigned with the registrar and completion will be monitored through the Graduate Student Tracking System (GSTS), which you must keep current. A guide to GSTS is found in the appendix and on the TGS website. All details of the curriculum are discussed in substantial detail in Section 3.

SECTION 2d. CONTINUATION DECISION

For a typical student, the program faculty will evaluate academic performance at the end of the Summer quarter of the first year. The following are required to pass this evaluation and be considered for continuation in the PhD program:

1. An overall GPA of at least 3.5 in required graduate courses.
2. Progress towards course completion in agreement with the DGS-approved course plan.
3. Positive comments from the instructors of all classes completed to date.
4. Adequate progress in research, as judged by the advisor in a written document.

For students with a substantially altered course plan (such as entering with a non-ChemE BS or BE), the formal continuation decision may be delayed by one or more quarters without impacting the progress of the student.

The outcome of the evaluation will be communicated to the students by October 1st by letter. This letter may include a commendation for exceptional performance in the first year, and it may contain a summary of comments from the continuation meeting intended to help the student succeed.

In the event that a student is not recommended for continuation, this constitutes a lack of 'satisfactory academic progress,' as per TGS policy. The student will typically be asked to complete one or two additional quarters of research during a Probation period, during which time a revised continuation decision may be made, or the student will be Excluded and awarded a thesis-based Masters degree. Financial support will continue unaffected during this period. In rare instances, the Department exercises the right to Exclude the student immediately. If the student has completed the necessary course requirements and maintained an adequate GPA, they may be awarded a coursework-based Masters degree at that time.

NOTE: Any student receiving more than 4 quarters of financial support is ONLY eligible for a thesis-based MS. If no acceptable MS-level thesis is written, they will not receive a graduate degree from Northwestern.

SECTION 2e. ANNUAL REVIEW

At the end of each academic year, the student will be asked to complete an annual progress report through the Graduate Student Tracking System (GSTS). A guide to GSTS is found in the appendix and on the TGS website. The student will give a narrative description of their work over the year, describe their project as a whole, and provide an update of awards, presentations, publications, and other work products. Perhaps most importantly, the student will provide a plan for the following year.

This progress report and plan must be approved by the research advisor. This progress report is required for all TGS programs and is akin to an 'individual development plan', as required by many NIH programs. Advisors may use additional methods of progress review at their discretion, and students are encouraged to frequently discuss progress with their advisors.

An annual report showing unacceptable progress is grounds for a student being placed on Probation. The student has two quarters to show 'satisfactory academic progress,' and if adequate progress is not made, the student may be Excluded. In the event of Exclusion proceedings at any point after the Continuation decision, the student will be asked to write a short thesis during the Probation period, and they may be awarded a thesis-based Masters degree. Financial support will continue unaffected during this period. In rare instances, the Department exercises the right to Exclude a student immediately following an annual report of inadequate progress being made. In no circumstances will a student be eligible for a coursework-based MS.

SECTION 2f. THESIS COMMITTEE and PROPOSAL

THESIS COMMITTEE

PhD proposals and PhD theses are evaluated by a group of faculty known as the thesis committee. The thesis committee is made up of the chair, who is the thesis advisor or one of the co-advisors, and at least three additional members. In total, at least one member must be a faculty member outside the Department, and at least two must have a core appointment in the Department. Note that it is possible to have committee members who are not part of the Northwestern University community, such as collaborators at other universities, national laboratories, or in industry.

Students should consult with their advisor(s) about who should serve on the committee. Committee members become more familiar with the student and the research than the typical faculty in the Department, and they may be able to provide useful scientific and career advice, or letters of recommendation. Once the student develops a list of potential committee members, they should secure their participation by email or in person, then fill out the relevant section in GSTS and the corresponding form in the Student Enterprise System (CAESAR). A guide to GSTS is found in the appendix and on the TGS website.

PhD PROPOSAL (Qualifying Exam and PhD Prospectus)

Typical students should select their committee by the 8th quarter and defend a PhD proposal by the end of the 9th quarter. An important clarification is that our proposal counts as both the PhD qualifying exam and the PhD prospectus. Once a student knows the date of the proposal, they must notify the Graduate Program Assistant and use CAESAR to fill out the form for the PhD prospectus. At the time of the research proposal, the committee will also consider classroom performance to date, and thus, all courses must be completed before a student may defend their proposal. Failure to successfully defend a proposal is a failure to show 'satisfactory academic progress,' per TGS guidelines, and may result in being placed on Probation, which can lead to Exclusion within two quarters. The student will be asked to write a short thesis during the Probation period,

and they may be awarded a thesis-based Masters degree. Financial support will continue unaffected during this period. In rare instances, the Department exercises the right to Exclude a student immediately following an unsatisfactory PhD proposal. In no circumstances will a student be eligible for a coursework-based MS. Even without program action, failure to complete the Proposal by the end of the third year will result in Probation, as per TGS guidelines.

The presentation of the proposal comprises two tasks: a written document and an oral defense of the proposal. Both parts are extremely important parts of a student's development towards the PhD. The student should allow ample time to edit and polish the proposal, and to develop and practice making the oral presentation and answering questions. The student is encouraged to seek their advisor's input in the structuring of the proposal documents, but they are reminded that the proposal must represent their own work and their own ideas.

A good proposal should be concise, but convey all of the following:

1. The objective(s) of the research – what is planned to be accomplished.
2. The significance of the research – what impact would the accomplished objective(s) have, assuming that the research is successful as planned.
3. Literature background – enough description of prior knowledge for readers to understand what is deficient that makes the proposed work important and useful, and what is known so that the proposed work has a reasonable chance of success. All critical references must be included.
4. Plan – in a logical manner, describe foreseen difficulties, options and plans to overcome the difficulties.
5. A brief description of procedures, be they theoretical, analytical, computational, or experimental.
6. A brief description of work completed by the student to date. This may be included under (3), as a separate section, or as an appendix, as appropriate.

A PhD represents a unique and significant contribution to science and engineering and is not simply a collection of papers, as impactful as they may be. Moreover, the PhD does not necessarily culminate in a 'better' device, but rather an improved understanding of a subject. The proposal must explain how the student will make a significant, impactful, and independent contribution to science and engineering.

The written proposal should be provided to the committee members two weeks prior to the proposal defense, so that the committee members have adequate time to review it and to provide feedback. Any deviation from the timetable must be approved by the committee in advance. The document should be approximately 30 pages of double-spaced text, including images, tables, etc., but not including references. There should be a separate cover page, abstract, and table of contents.

The oral defense should contain material appropriate for a 30-minute seminar, if it were to be given uninterrupted. Backup slides are highly recommended. The student is likely to be asked many questions, so the proposal should be scheduled for a two-hour block, unless instructed otherwise by the Chair.

In this defense, the committee will (a) ascertain a student's command of the material being presented, (b) assess the overall research plan, (c) help the student better develop their plan, and (d) consider the student's classroom performance, as deemed necessary. During the defense, the role of the Chair is to help guide the questions, and students are expected to be able to independently defend all aspects of their proposed work.

If a student successfully defends their Ph.D. proposal, they officially become a doctoral candidate.

**A checklist is provided in the appendices for setting a committee and preparing the proposal.

SECTION 2g. FOURTH YEAR REVIEW.

The fourth year review is a chance for the committee to reconvene and assess the student's progress toward completing the thesis work. The student must plan a 20-30 minute oral presentation that updates the committee members on work completed since the proposal defense and the student's plan to complete their work in a timely fashion. A two-page written summary should be provided to the committee members one week prior to the date of the oral presentation. This is the perfect time to obtain feedback on research and to discuss a student's post-graduation plans.

The student should schedule approximately one hour for the review sometime during the Winter or Spring quarters of their 4th year. When the student knows the date of their review, they must contact the graduate program assistant to obtain the review form.

As with the annual reports, an unfavorable 4th year review is a failure to demonstrate 'satisfactory academic progress,' per TGS guidelines, and is grounds for being placed on Probation, then Exclusion, if not remedied.

**A checklist is provided in the appendices for preparing for the fourth-year review.

SECTION 2h. DISSERTATION and PROGRAM COMPLETION

DEPARTMENTAL SEMINAR

Before the thesis defense, and typically in the Fall or Spring of their 5th year, every student must make a 20-25 minute presentation to the entire Department. This presentation will be scheduled during one of the Departmental Colloquia slots. In some cases, members of certain centers (e.g. the Center for Catalysis and Surface Science) may present their colloquium in that venue instead. Finally, winners of the Distinguished Graduate Researcher Award and the runners-up present their colloquium at the annual Departmental retreat in September. Students must keep in mind the broad range of interests and expertise of the audience and prepare a talk low on technical details and high on motivation and insight.

The student is asked to schedule the seminar well in advance of their desired graduation date and to provide the Graduate Program Assistant with a brief summary of the presentation for posting in a flier. Dates should be selected in consultation with the student's advisor to ensure their availability.

DISSERTATION

A student's dissertation is the document detailing the work they have completed for their thesis. In a dissertation, a student must demonstrate the relevance of their work to the greater scientific enterprise, place their work in the context of both its narrow and broader fields, and describe their results and demonstrate their technical validity. Finally, a student must detail the conclusions to be drawn from their results, and how those conclusions advance the field.

The exact structure of the dissertation, including length, citation format, use of figures, etc., is strongly field-dependent. The student must find out what is accepted practice from their advisor and from prior students in their research group and in related groups. Some specific formatting guidelines are given by TGS and must be followed (title page, margins, pagination, etc.). Ultimately, the student will need to submit a digital copy of the document through ProQuest. That service will also generate any bound hardcopies that the student or their advisor may need. TGS also has many specific policies on other topics not necessarily of relevance to all students, such as Dissertation Embargos (delayed release) and on acknowledging 3rd party editors. For

additional details, see the TGS policy on PhD Degree requirements found on their official site.

THESIS DEFENSE

The defense is the final presentation given to the thesis committee. Students should prepare a presentation that would last 30-45 minutes, if no questions were asked. Depending on the desires of the committee, they may either interrupt the student during the presentation, or reserve all questions for the end. The faculty will ask broad and specific questions related to the student's research, and the student should typically schedule a two-hour block with the committee for the defense, unless otherwise directed by the Chair. During the dissertation defense, questions may be asked about anything in the presentation, thesis, or entire body of work. The committee seeks to understand each student's unique, substantive contribution to new scientific understanding, which is the purpose of the PhD.

Peer review is one of the essential mechanisms by which relevance to the research field is determined. Thus, as part of demonstrating a student's independent contribution to the field, it is typically expected that students publish one or more items in the peer-reviewed literature before the date of the thesis defense. The committee may have additional expectations.

At the conclusion of the defense, the committee will meet privately to evaluate and collectively decide whether to award the PhD. It is important to remember that the decision is made collectively by the committee, and not solely by the advisor(s).


If the student wishes and the committee approves, the first portion of the thesis defense may be open to the public, including friends and family. Typically, most questions by the committee would then be reserved for a closed session immediately following the public presentation.

All requirements, including a successful thesis defense, for the doctoral degree must be met within nine (9) years of initial registration in a doctoral program. However, the program does not typically guarantee support beyond five (5) years. Substantial delays beyond 5 years can indicate a lack of 'satisfactory academic progress,' as per TGS policy, potentially leading to Probation and eventually Exclusion.

OTHER REQUIREMENTS

The Graduate School offers quarterly graduation for graduate students. Students working towards a Master's or PhD degree may be awarded the degree in Fall, Winter, Spring, or Summer, assuming all work is completed before the published deadlines. It is very important that students abide by these deadlines, as they are set by TGS and cannot be moved. Deadlines for graduation and for participation in the ceremonies are posted on TGS's main calendar. NOTE: Students must be continuously enrolled until all graduation requirements are met. In some cases of off-cycle graduation or missed deadlines, a student may need to register for TGS 512 'continuous registration' at their own cost (currently ~\$100), even after they have completed all degree requirements and are not drawing a stipend. Graduate program staff work with students in such a situation.

Departing students must fill out the PhD exit survey and the Survey of Earned Doctorates from the TGS website, return all keys, and depending on circumstances, cancel Northwestern health insurance or reconcile items with payroll. Many research groups will have specific exit protocols that must be followed, including sample archiving and data management. Students are directed to consult their advisor and the Graduate Program Assistant to make sure that all exit requirements have been met.

**A  checklist is provided in the appendices for the dissertation, defense, and degree completion.

SECTION 3. CURRICULUM

SECTION 3a. DISTRIBUTION of COURSES

Graduate students holding BS or BE degrees in chemical engineering must complete ten (10) courses according to the distribution below. In addition, there are several other requirements that are managed through the registrar. See Section 3b below. Students entering with relevant, prior graduate coursework should see Section 3c below. Students entering with a BS or BE in another engineering or science discipline should see Section 3d below.

All students must enter and update a course plan within GSTS so that the DGS can approve or further discuss course plans as needed. In any given quarter, a student must take between 3.0 and 4.0 units of credit. Under normal circumstances, a student should plan to complete 9-10 courses in their first three quarters. Delaying more than one elective until the second year should not be done without explicit approval from the DGS. Furthermore, failing to register on time for any quarter may delay a student's paycheck. This includes summer quarters when students only register for research.

Most courses taken by PhD students will be graded, and no CHEM_ENG graduate courses are open to registration under the P/N (Pass-No Credit) option. A student will be placed on Probation at the close of any quarter if their overall grade average is below 3.0, and failure to improve may lead to Exclusion by The Graduate School. Additionally, the Chemical Engineering program requires that students maintain a minimum GPA of 3.5 to continue in the program.

The PhD program in Chemical and Biological Engineering requires (typical quarters offered):

Four core, graduate-level chemical engineering courses.

CHEM ENG 421 Fluid Mechanics (typically Fall)

CHEM ENG 422 Heat and Mass Transfer (typically Winter)

CHEM ENG 408 Chemical Engineering Kinetics and Reactor Design (typically Fall)

CHEM ENG 404 Advanced Thermodynamics (typically Spring)

Two electives within the Department, among those listed as a TGS course with the registrar.

Two out-of-Department technical electives, among those listed as a TGS course with the registrar.

Two other technical electives, either within or outside the Department, among those listed as a TGS course with the registrar.

NOTES:

- Of the last two categories of electives, one may be taken P/N, if also allowed by the registrar.
- Most 300-level courses that are required for a BS degree in chemical engineering at Northwestern WILL NOT be accepted for credit toward a graduate degree. CHEM ENG 341, Process Dynamics and Control is the only exception, if this course does not duplicate a course taken for a previous degree.
- Electives must have significant technical content and be listed as a TGS course. If in doubt, the student should ask the DGS. In rare cases, the DGS may give permission to take up to one non-TGS listed course as a technical elective if it has particular relevance to the student's research.
- CHEM ENG 499, Independent Study, cannot be used as a technical elective except as described in Section 3c for students entering with a prior MS degree.
- The Department website gives the courses offered and times for each year.
- Courses that received a P during Spring 2020 can be used as a letter grade for all graduation requirements.

SECTION 3b. OTHER PROGRAM ACTIVITIES

SEMINAR

The weekly departmental seminar is an important part of the PhD program. All students are expected to attend all seminars in their first two years and should attend as much as possible during their PhD career.

As such, all PhD students must enroll in CHEM ENG 510 for at least four quarters in the first two years of enrollment. This is a zero-credit, S/U course that was created with the goal of impressing upon all students the importance that the program places on colloquium attendance and participation in departmental activities. A satisfactory grade will be awarded based on attendance of no fewer than 7 seminars (6 seminars plus retreat in Fall quarter). After the Fall quarter of their first year, students working at the downtown campus may use seminars other than the departmental seminar to fulfill the requirements.

PROFESSIONAL SKILLS

All PhD students must enroll in the two-part professional skills development course. Students will register for CHEM ENG 520-0 (0 credit) for the Fall quarter of their first year and CHEM ENG 520-1 (1 credit) in the Fall of their second year. This course emphasizes professional development skills and diversity, equity, and inclusion topics necessary to succeed as a graduate student. Fellowship proposal writing and preparing presentations are important parts of the course.

RESPONSIBLE CONDUCT OF RESEARCH

All PhD students must enroll in GEN ENG 519 within their first three quarters. This is a zero-credit, S/U course that educates students about responsible conduct of research. The student must also complete an on-line course offered by CITI. The online course can and should be completed immediately. This course is a federal requirement. No student can receive financial support, regardless of their funding source, if they do not complete this course.

RESEARCH CREDITS

In the first eight (8) quarters, students must be registered for 3.0 to 4.0 units of credit total from a mixture of coursework and research credit (CHEM ENG 590). In the ninth quarter and following, students sign up for TGS 500, a zero-credit course, every quarter. This is the only course needed to maintain full-time enrollment. Students should confirm with official policy on the TGS website.

TEACHING

When acting as a teaching assistant or a Department-assigned substitute, students **MUST** register for GEN ENG 545 or GEN ENG 546 as appropriate. See Section 4a. Failure to do so can jeopardize the ability to graduate.

SECTION 3c. ENTERING with PRIOR GRADUATE COURSEWORK

Students entering with an MS in chemical engineering or a similar discipline from another institution may have certain courses waived at Northwestern that were completed elsewhere. Students entering with an MS must eventually complete the required four (4) core courses and six (6) elective courses, either at their previous MS institution or at Northwestern. Students are also required to take a minimum of seven (7) graduate courses at Northwestern and a minimum of two (2) in the Chemical and Biological Engineering Department. The DGS must approve (and note on GSTS) the graduate classes from the previous institution that they intend to use as replacements for courses required by our program. These students will then register in quarters 2 or 3 for up to 3.0 credits of CHEM ENG 499 taken for a letter grade, so as to reach a total of ten (10) credits. For example,

a student entering with an MS may use their prior courses to satisfy the four core courses and one out-of-Department elective. They would then be required to take seven (7) graduate courses with at least two (2) as in-the-Department. They would also register for three (3) units of CHEM ENG 499. The grades in 499 will NOT be used in calculating the targeted 3.5 graduate GPA. However, the grades will be used in the student's evaluation of research acuity.

Students with graduate coursework in the core subjects (thermodynamics, kinetics & reaction engineering, or transport phenomena) from another university, but not a MS degree, may be allowed to substitute up to three (3) technical electives for courses taken (For example, if a student takes graduate fluid mechanics at another institution, they would not be required to take CHEM ENG 421, but they would be required to take an additional elective.) The student must have obtained a grade of at least A- or its equivalent, and a syllabus must be provided. This allowance is made at the discretion of the DGS. No reduction in the total number of required courses will be awarded.

Students who have completed a relevant professional Masters program at Northwestern, such as the Master of Biotechnology, are treated as other students entering with graduate coursework, with credit typically being awarded towards electives. These students may be able to apply their prior coursework towards the TGS minimums. All allowances are made at the discretion of the DGS and subject to a TGS degree audit.

Regardless of coursework completed prior to entering the Northwestern graduate (PhD or MS) program, CHEM ENG 520 (Professional Skills Seminar), GEN ENG 519 (Responsible Conduct in Research), CHEM ENG 510 (seminar), and teaching requirements remain the same. Students must meet the TGS minimum of nine (9) TGS courses (see Section 4b).

SECTION 3d. ENTERING with NON-CHBE BS or BE

To receive a PhD in chemical engineering, students must demonstrate proficiency in key concepts that are typically found only in the undergraduate chemical engineering curriculum. This is accomplished through 1) completing an equivalent course at their home institution, 2) completing the specified course at Northwestern, or 3) passing (B or better) a comprehensive exam in that subject administered by the Department.

All students must demonstrate mastery of the material found in CHEM_ENG 321 (typically Fall, Fluid Dynamics), CHEM_ENG 322 (typically Winter, Heat Transfer), and CHEM_ENG 307 (typically Spring, Reactor Engineering). Students entering without a degree or appropriate chemical engineering coursework from their prior institution will be required to take these courses or pass a comprehensive exam before the start of their graduate equivalent courses: CHEM_ENG 421 (typically Fall), CHEM_ENG 422 (typically Winter), or CHEM_ENG 408 (typically Fall). Students must notify the DGS before the start of the relevant quarter if they wish to take the comprehensive exam. It is highly recommended to discuss this early, as preparation materials and strategies can be suggested.

Depending on their prior preparation, it may also be advised that a student enroll in CHEM_ENG 211 (Fall or Winter, Thermodynamics) and/or CHEM_ENG 323 (Spring, Mass Transfer) as a prerequisite for graduate-level coursework. Students without a degree in chemical engineering may wish to audit CHEM_ENG 210 and/or 212 to gain familiarity with the material, but it is not required. These courses will be graded, but they will not contribute toward other graduate degree course requirements, including the calculation of the 3.5 GPA required by the Department. An individual degree plan through GSTS, made in consultation with the DGS, is particularly important for these students.

REMINDER: The formal continuation decision for these students may be delayed by one or more quarters, but it will not typically change subsequent milestone dates for the student.

SECTION 3e. LANGUAGE PROFICIENCY

All PhD students whose prior degrees were not in U.S. schools or from certain exempted institutions must demonstrate proficiency in spoken English. Students needing to take any of these programs will be contacted directly by the program or by TGS. Currently, English proficiency can be determined as follows:

- A score of 26 or higher on the speaking section of the TOEFL internet-based test
- A score of 65 or higher on the Versant test, administered by TGS, or a score of 63 or 64 on two separate occasions. The tests need not be consecutive.
- A score of 50 or higher on the SPEAK test, an alternative test also offered by TGS.

LING 380 and 381 are recommended for students not initially passing the Versant or may be required for students with low scores. Another course, LING 480, addresses common situations encountered while TAing, and a passing performance in LING 480 will fulfill the English proficiency requirement.

SECTION 4. KEY PROGRAM POLICIES

SECTION 4a. TEACHING

All students in the PhD program must complete four (4) quarters of duties as a teaching assistant (TA) for a CHEM_ENG or MBIOTECH course or a Department-assigned substitute. Department-assigned substitutes may include organizing graduate student recruiting. The program considers teaching experience to be an essential part of a student's graduate education. Therefore, there are generally no exceptions to the teaching requirement, even if an internal fellowship (e.g., ISEN) requires service as a TA for a non-departmental course or activity or a student possesses an external fellowship.

A typical time commitment of a TA is 8 hours per week, depending on the course and instructor, and is not intended to significantly supplant research activities for the quarter. Some students may be assigned as a 'paid' TA, which requires additional time commitment, and is intended to be in lieu of some research activities for that quarter. Students on external fellowship (e.g. NSF Graduate Research Fellowship) should not generally act as a 'paid' TA. There is an excellent student-generated document that can help students manage expectations for the various courses to which they may be assigned. Student input is sought when TA positions are assigned, but a student cannot be guaranteed a particular position.

Every year, a faculty committee uses CTEC scores and nomination forms to select several graduate students who perform their TA duties outstandingly. The winner(s) receive a plaque and a cash award.

In quarters that a student is acting as a TA, they must sign up for GEN ENG 545, a zero-unit course, for tracking purposes. Students acting as a 'paid' TA should sign up for GEN ENG 546. Failure to sign up for these courses could jeopardize the student's ability to graduate.

THE TEACHING APPRENTICESHIP

A special opportunity for students interested in academic careers is the program's Teaching Apprenticeship Program (TAP). Graduate students admitted to the TAP work closely with faculty mentors to teach two to four weeks of a course, typically a core undergraduate chemical engineering class. The apprentice teaches the course as a faculty member would, preparing lectures, assigning homework, and writing and grading quizzes and exams. The faculty mentor attends the apprentice's lectures and provides feedback. The apprentice's performance is also evaluated formally by the students in the class.

Interested students typically apply to the Teaching Apprenticeship Program (TAP) in the Spring prior to their fourth or fifth year. The Graduate Committee evaluates applicants to the program and selects 2-3 qualified students. In the event that a Graduate Committee faculty member is the advisor of a TAP applicant, an alternative faculty member is appointed by the Department Chair. TAP participants are excused from the usual teaching assistant assignment during the year in which they serve as an apprentice. TAP participants are often, but not exclusively, interested in academic careers.

SECTION 4b. TRANSFER

The MS program in Chemical Engineering is structured as a terminal degree. MS students cannot apply as a new student for any Northwestern PhD program and cannot initiate a transfer request on their own. In rare circumstances, a faculty member can initiate a request for transfer to a PhD program on behalf of a current MS student. Faculty members are directed to speak with the DGS for further details.

Current Master of Biotechnology Program (MBP) students must formally apply for the PhD program. No direct transfers are possible because MBP is not part of TGS.

If a student is interested in leaving the PhD program for any reason, they are urged to contact their research advisor or the DGS as soon as possible so that concerns may be addressed and that an appropriate plan may be made.

SECTION 4c. FINANCES

All students in the chemical engineering PhD program who are making satisfactory academic progress and meeting progress milestones receive financial support, which includes a stipend, full tuition, and health care premiums. In the event of any lapses of payment of stipend, tuition, or health care premiums, the student should immediately notify the Department administrator. The student should not pay these independently.

In the event that a student will be taking a leave or will be suspending their stipend (e.g. for an external internship), it is incumbent upon the student to notify the Department office well in advance so that proper arrangements may be made and gaps in pay can be avoided.

In addition to these resources, TGS and the University provide a number of forms of additional assistance, such as childcare grants, childcare fee assistance, or emergency loans. Students should make any potential financial hardships known to the DGS, and they may be able to help to secure additional support, to the best of their ability.

SECTION 4d. VACATION TIME, ACCOMODATION, and LEAVES

Nearly all PhD students, including those with external fellowships such as the NSF Graduate Research Fellowship, receive financial aid through the University via Research Assistantships, Fellowships, or Teaching Assistantships. As such, students are entitled to staff holidays including Memorial Day, Independence Day, Labor Day, Thanksgiving & the day after, Christmas Eve & Day, and New Year's Eve & Day. See the Human Resources calendar for a full list of dates.

A PhD student DOES NOT share the same vacation schedule as an undergraduate or self-funded graduate student. A total of two weeks personal vacation per year is considered normal for a satisfactory student. All paid vacation or excused absences MUST be arranged in advance with their faculty advisor.

For time away from the University longer than possible with reasonable vacation or sick time, a Leave is possible. The program follows TGS policy with respect to Parental Accommodation and for Personal, Medical, or Family Leave. In addition, the program will work with students and TGS to develop other reasonable accommodations that may be needed. Please initiate any official requests for accommodations through AccessibleNU.

SECTION 4e. FELLOWSHIPS, INTERNSHIPS, and PROFESSIONAL DEVELOPMENT.

FELLOWSHIPS

Financial support is provided for all students making satisfactory progress. However, there are a number of external and internal fellowships for which students should consider applying. These can increase the stipend, open up new opportunities for flexibility in research, and can be quite prestigious. TGS maintains pages on available opportunities, but students should also seek advice from their advisor or the DGS. Preparing application narratives for marquee fellowships are supported by the Office of Fellowships. Some common classes of research fellowships are given below.

Early-career, external fellowships are offered by the US Department of Energy, National Science Foundation (GRFP), Department of Homeland Security, Environmental Protection Agency, and the Department of Defense (NDSEG). Prestigious awards administered by private foundations include the P.E.O. Foundation, the Hertz Foundation, the Link Fellowship, the ARCS Foundation, the Soros Fellowships, the Ford Foundation Fellowships, the GEM Fellowship, the National Physical Society, the American Chemical Society, and many others. Research each for information about eligibility.

Students are highly encouraged to apply for these external fellowships in their first or second years.

Internal fellowships include the Ryan Fellowship (nanoscience), the John Nicholson Fellowship (basic sciences and engineering) and the Presidential fellowship (University-wide, terminal-year fellowship). These and other fellowships are highly competitive and require nominations, which will be solicited periodically by the Department or the research advisors.

Training grants are also available at Northwestern University, and the Chemical Engineering program is currently closely affiliated with three: the Chemistry of Life Processes Training Program, the Biotechnology Training Program, and the Convergent Synthetic Biology Training Program. These grants can support the studies of selected graduate students for 2 to 5 years. Typically, applications are requested from first and second year students during the Spring quarter. To be eligible for one of these training grants, students must participate in a rotation in one of the member laboratories, in addition to other events. Note that these fellowships are very competitive, so a student needs to have performed at a high level in their coursework and research in order to be competitive. Even if a student does not apply for or receive a fellowship, they should make themselves familiar with the training grant activities, as those can enrich the graduate school experience and lead to contacts across the University.

TGS also offers a useful **Conference Travel Grant** and a Dependent Care Grant, which can be used to subsidize travel (and affiliated dependent care expenses) to a conference or other form of professional development.

INTERNSHIPS

Some students, with the support of their advisors, may find practical internships within industry, the national laboratories, or in the Federal government, such as through the Mirzayan Fellowship. Internships that involve time off campus are collectively managed through the Crown Family Internship. These experiences are best suited for the middle to latter stages (e.g., 3rd year) of PhD study, after candidacy. These 3 to 6 month, full-time internships are generally a paid position. It is expected that this experience will not require additional time to complete degree requirements. See TGS documentation for official policies. Students **MUST** discuss an internship well in advance (years, potentially) with their research advisor. Prior to the internship, students will need to complete an application for the Crown Graduate Internship Application and register for CRDV 510. This is critical, as it is needed to maintain continuous enrollment and health insurance benefits.

PROFESSIONAL DEVELOPMENT

PhD students are allowed opportunities for professional and academic growth, including those outside the program. However, external opportunities should be discussed with the student's advisor before embarking. Any program involving significant time away from research **MUST** be discussed with the research advisor. These include:

- TGS runs many workshops on fellowship writing and presenting one's work. These include writing boot camps, a fellowship workshop, and the Research Communication Training Program (RCTP).
- Other opportunities for professional development within the PhD program include joining a committee of the graduate student governance, participating in one of many outreach activities, acting on the Retreat Committee or other departmental committees, or becoming more involved in laboratory management.
- Kellogg offers a popular (and highly selective) program on Management for Scientists and Engineers, but also frequently offers courses to the wider NU community on their Facebook page, if space remains after the business students finish enrollment.
- Several programs are in place that support graduate students to carry out part of their work at the national laboratories of the US Department of Energy, or the National Institute of Standards and Technologies, or in foreign countries (DAAD, BAEF, etc.) Other fellowships help students get access to specialized resources, such as supercomputing time. Students are urged to consult with their advisors about such opportunities.

SECTION 4f. CONFLICT OF INTEREST AND COMMITMENT

The program in Chemical and Biological Engineering follows the conflict of interest and conflict of commitment policies of the University. Students are directed to the University web pages for the Conflict of Interest Office and the Office for Research Integrity. While students are not generally required to make the conflict of interest statements that are required annually of faculty and staff, participation in research carries certain obligations. All students are recommended to be aware of TGS and University general policies, as they can become very important if a student is involved in developing intellectual property or a company while at Northwestern, and in the student's future career. Two specific areas of attention are discussed below.

STUDENT ENGAGEMENT IN FACULTY ENTERPRISES

There are numerous faculty that actively consult or have developed companies based on their research. There is a specific policy from the Conflict of Interest Office to which students should refer if they are asked to engage in research or any other work related to such faculty activities, if it is outside the scope of a sponsored research agreement. Specifically, students cannot be coerced, and any work should promote educational and professional growth without preventing satisfactory academic progress.

EFFORT COMMITMENT

Essentially all students performing research at Northwestern do so under the umbrella of 'sponsored research'. Sponsored research can include federal or state government support, support from private foundations, or support from companies. Students receiving federal fellowships (e.g. the NSF Graduate Research Fellowship) are under the same guidelines.

Sponsored research requires a commitment of effort, typically 100%, except in very special cases. This 100% effort commitment requires that any outside scientific, professional, or business activities involving more than a trivial amount of time must be monitored and should be closely aligned with their research or educational development. Any activity that interferes with this 100% obligation is a conflict of commitment.

Potential conflicts of commitment include any paid employment, engaging in startup activities (even if unpaid) unrelated to your research or a class, self-employment, or work as an independent contractor. The latter classes of conflict could include activities like managing a high volume Etsy account or extensive driving for Uber. TGS requires the Graduate Student Permission to Work Request Form when external activities exceed particular thresholds of time or compensation (see TGS guidelines for more details). Regardless of thresholds, students MUST discuss ALL potential conflicts of commitment with their research advisor. True conflicts of commitment must be approved by the Department Chair and the university Conflict of Interest Office. Effort commitments are certified by Principal Investigators on research grants (i.e. your research advisor) and by several offices within Northwestern. An unreported conflict of commitment is therefore a form of falsification of research effort and can result in the cancellation of grants, federal audits of the entire Northwestern community, or even criminal prosecution. Conflicts of commitment can also invalidate intellectual property generated at Northwestern or the other entity.

Penalties for a student violating effort commitment policies are the same as any other conduct violation, as discussed in Section 5c below.

Note that nothing in this Section is to be construed as restricting a student's ability to engage in recreational, community service, or other forms of leisure activity outside of the student's academic and research time commitments.

SECTION 5. ACADEMIC AFFAIRS

SECTION 5a. STANDING and PROBATION

A student whose overall grade average is below B (3.0 GPA) or who has more than three incomplete grades will be placed on probation by The Graduate School and will not be in good academic standing. A student that fails to maintain 'satisfactory academic progress' in their program will be placed on probation and will not be in good academic standing. To be in good academic standing in The Graduate School, the student must meet both the standards set by the Chemical Engineering PhD degree program and those set by The Graduate School. Moreover, a student must make satisfactory progress toward fulfilling all requirements for the degree (see Section 2). Failure to make satisfactory academic progress may be a result of (but is not limited to): unsatisfactory performance in classes, unsatisfactory performance on the proposal, unsatisfactory research progress, or failure to meet other program requirements (such as language proficiency). A student's failure to make satisfactory progress must be reported by the student's program to the student, as well as to The Graduate School. Students are referred online for The Graduate School's official policies on satisfactory academic progress.

SECTION 5b. EXCLUSION

EXCLUSION

Exclusion is defined by The Graduate School. A student who fails to resume good academic standing after at most two quarters after the quarter of being notified of their placement on probation by either The Graduate School or the program will be excluded from The Graduate School.

A student can also be excluded by a program without first being put on probation, but only in cases that have been stated clearly by the program (such as in Section 2) and disseminated to the student effectively. Prior to exclusion, a student is given reasonable opportunity to remediate the deficiency. Exclusion always requires approval from both the Director of Graduate Studies and the Chair of the Department.

NOTIFICATION OF EXCLUSION

When a decision to Exclude is made, both the student and TGS must be informed in writing within three business days of the decision being made. The notification must include the effective date of the exclusion, a clear statement of the reason(s) for exclusion and any relevant documentation.

APPEALS PROCESS

Students wishing to appeal a program's decision to exclude must first appeal directly to the program. The program must inform both the student and TGS of the outcome of the student's appeal(s) in writing. A student may appeal program decisions to TGS. Appeals will only be considered by TGS on the basis of procedural errors or failure to comply with established program or TGS policy. The Graduate School will not consider appeals based on academic decisions.

Appeals to TGS must be made in writing within ten days of the program's final written determination of exclusion and include any supporting materials at that time. The Dean of The Graduate School will determine if an appeal should be administered within TGS, UHAS (University Hearing and Appeals System), or other sanctioning body within the University. The Dean may request additional information from, or a meeting with, the student and/or program before making a final decision. The Dean's decision will be made in a timely manner and will be communicated in writing to the student and program. This decision is final and cannot be further appealed.

SECTION 5c. IMPROPER CONDUCT

Cases of improper academic and/or research conduct, and inappropriate or unprofessional behavior are considered outside the boundaries of 'satisfactory academic progress.' These cases are covered separately under TGS's Academic Integrity policy, as well as the published policies of the Office for Research Integrity, the Office of Equal Opportunity and Access, and the Student Handbook. These cases are addressed according to the University's existing disciplinary procedures and may result in a range of sanctions up to and including Exclusion from the University.

The program in Chemical and Biological Engineering takes laboratory safety very seriously. Repeated and/or willful violations of safe laboratory practices can be grounds for probation or Exclusion and can be reported as a violation of the University Code of Conduct.

DISCRIMINATION AND HARASSMENT

All members of the Northwestern community – faculty, staff, students, and contracted vendors – share a collective responsibility for creating a harassment-free environment. To this end, the program encourages all students to familiarize themselves with Northwestern's policies against discrimination, harassment, and sexual harassment and the resources available on campus dedicated to the prevention, investigation, and resolution of claims of discrimination and harassment.

Northwestern University does not discriminate or permit discrimination by any member of its community against any individual on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship or veteran status in matters of admissions, employment, housing or services or in the educational programs or activities it operates.

Harassment, whether verbal, physical or visual, that is based on any of these characteristics, is a form of discrimination. This includes harassing conduct affecting tangible job benefits, interfering unreasonably with an individual's academic or work performance, or creating what a reasonable person would sense is an intimidating, hostile or offensive environment.

While Northwestern University is committed to the principles of free inquiry and free expression, discrimination and harassment identified in this policy are neither legally protected expression nor the proper exercise of academic freedom. Examples of discrimination and harassment may include:

- refusing to hire or promote someone because of the person's protected status
- demoting or terminating someone because of the person's protected status
- jokes or epithets about another person's protected status
- teasing or practical jokes directed at a person based on their protected status
- the display or circulation of written materials or pictures that degrade a person or group
- verbal abuse or insults about, directed at, or made in the presence of an individual or group of individuals in a protected group.

McCormick and TGS have several on-site Discrimination and Harassment Prevention Advisers. See the site of the Sexual Harassment Prevention Office for current listings and contact information.

CONFIDENTIAL COUNSELORS

If a student wishes to speak with someone who is legally privileged to keep communications confidential, they may contact a confidential counselor. After consulting with a confidential counselor, the student is within their discretion to take no further action. Because of the confidential nature of the counselor/patient relationship, seeking advice from a confidential counselor does not constitute reporting an incident.

EthicsPoint HOTLINE

Northwestern has selected EthicsPoint to provide the community with a simple way to report activities that may involve misconduct or violations of University policy. Anyone may file a report online or by calling 866-294-3545. This service is not a substitute for, nor does it supersede, any existing reporting methods or protocols already in place at Northwestern for reporting suspected problems or complaints. Instead, the EthicsPoint system provides an additional means of reporting such issues. Individuals who report concerns of sexual harassment via the EthicsPoint online option are encouraged to check the status of their report periodically, in order to receive updates as to the status of the investigation. Any suspected problems or complaints reported via EthicsPoint will be reviewed in accordance with relevant University policies and/or procedures and other requirements stated in the relevant Handbooks.

APPENDICES

APPENDIX A

Chemical and Biological Engineering Department PhD Student Checklist for Proposal and 4th Year Review

- **Proposal (aka Qualifying Exam)**
 - By end of 8th quarter of residence (typically summer of second year): discuss possible committee members with your thesis advisor. The committee needs two faculty with a primary appointment in ChBE, one outside of ChBE, and one other.
 - Early in 9th quarter: invite faculty members to serve on your committee. Send them a summary of your research and offer to meet with them. Enter your final committee in GSTS.
 - By mid-9th quarter: schedule a proposal defense date. Do not send your committee members an email asking them to send you their availability for a general period of time, like 'fall quarter'. Use a scheduling tool like Whenisgood or Doodle to narrow down dates and then times. Some faculty are difficult to schedule; plan for this. You will need a 2-hour block when all of the committee members are available.
 - Book a room for the defense. Book a three-hour block, which includes 30 minutes on each side of your scheduled presentation.
 - Fill out PhD Prospectus AND Qualifying Exam Forms in GSTS.
 - Let the program assistant know the date and time of your defense.
 - Fill out your PhD Exam Committee form through GSTS.
 - Two weeks prior to proposal defense date: Send your committee members your written proposal. Send it by email and ask if they want a hard copy delivered. Any delays in providing the document must be cleared with your committee in advance.
 - Prepare your presentation for proposal defense. The presentation should be about 20-30 minutes long if it were uninterrupted. Schedule a practice talk with group members or other relevant people. Revise the talk and work on backup slides.
 - Day of your presentation: make sure that your unofficial transcript is available for your committee if they request it. You can obtain this from the program assistant. You will be asked to step out of the room after all the committee members have arrived and before you start your presentation. You will also be asked to step out of the room after the presentation is concluded so that the committee can deliberate.
 - Passing your proposal defense is not official until the signed exam form has been returned to the program assistant, and the approval is entered online.
 - Deposit your proposal presentation and document in GSTS.
- **Fourth Year Review**
 - By the end of winter or spring quarter of your fourth year: Schedule your fourth-year review. Use a scheduling tool like Whenisgood or Doodle to narrow down dates and then times. You will need a 1-hour block when all committee members are available.
 - Book a room for the review. Book a two-hour block, which includes 30 minutes on each side of your scheduled presentation. Let the program assistant know the date and time for your review.
 - One week prior to review date: Send your committee members a written two-page summary of your research. It should focus on what aims you have accomplished to date and what you still have to complete to finish your PhD. Any delays in providing the document must be cleared with your committee in advance.
 - Prepare your presentation for fourth year review. The presentation should be about 20-30 minutes long if it were uninterrupted.
 - Obtain the 4th year review signature form from the program assistant and bring it to the review.
 - Passing your fourth year review is not official until the signed form has been returned to the program assistant, and the approval is entered online.
 - Deposit your 4th year review presentation and document in GSTS.

Chemical and Biological Engineering Department

PhD Student Checklist for Department Seminar and Degree Completion

- **Departmental seminar**
 - Summer prior to your fifth year: The seminar coordinator will send out a note to all graduate students entering their fifth year and beyond to ask about scheduling your departmental seminar. Respond with your preference of which quarter you would like to give your seminar.
 - Before the quarter of your preferred presentation quarter: Coordinate with your advisor(s) to identify dates when you are both available and communicate these dates with the seminar coordinator.
 - Prepare a presentation that is 25 minutes long for a 30-minute slot, allowing five minutes for questions.
 - Note that the seminar requirement can be fulfilled by speaking as the Distinguished Graduate Researcher at the fall retreat. With prior approval, one can also present at certain center meetings, such as the Center for Catalysis and Surface Science.
 - Deposit your seminar presentation in GSTS.
- **PhD Dissertation, Defense, and Degree Completion**
 - Approximately two months before you intend to defend: schedule a defense date. Use a scheduling tool like Whenisgood or Doodle to narrow down dates and then a 2-hour block of time. Defenses often cluster at certain times of the year, and some faculty are hard to schedule; plan accordingly.
 - Book a room for the defense. Book a three-hour block, which includes 30 minutes on each side of your scheduled presentation to allow for setup time and overrun.
 - Let the program assistant know the date and time of your defense.
 - Check deadlines for submission of all paperwork on the TGS website. Please note that all paperwork must be turned in more than four weeks in advance of the actual degree conferral date. For example, paperwork for a June degree is due in early May. The cutoff date for participating in the graduation ceremony may be later. For example, you might be able to participate in the June ceremony if you defend by early June, but you would receive an August degree.
 - Fill out the Application for Degree form on GSTS.
 - Fill out the PhD Final Exam form via GSTS. Print out a hard copy and bring it to the defense.
 - Two weeks prior to defense date: Send your committee members your written thesis by email and ask if they want a hard copy delivered. Any delays in providing the document must be cleared with your committee in advance.
 - Prepare your presentation for defense. The presentation should be about 45 minutes long if it were uninterrupted. You do not need to cover your entire thesis; you can focus on certain accomplishments.
 - Day of your presentation: make sure that your unofficial transcript is available for your committee if they request it. You can obtain this from the program assistant. You will be asked to step out of the room after all the committee members have arrived and before you start your presentation. You will also be asked to step out of the room after the presentation is concluded so that the committee can deliberate. Your defense is not official until the signed form has been returned to the program assistant and the approval is entered online.
 - Make any requested changes / corrections to your thesis and submit the final dissertation via ProQuest. Please see the TGS website for details. Please also note that the dissertation must conform to TGS formatting standards, which are available on their website. Discuss with your advisor the need for any bound copies of your dissertation, which are ordered through ProQuest.
 - Fill out PhD exit survey and the Survey of Earned Doctorates from the TGS website.
 - If you have any Y or K grades on your transcript, please make sure that the program assistant submits the appropriate change of grade form to TGS.
 - If appropriate, cancel your Northwestern health insurance. See the instructions on the TGS website.
 - For information on commencement and hooding ceremonies, please see emails from the McCormick Dean of graduate studies or check the TGS and McCormick websites. You must indicate your intent to participate in the various ceremonies and ensure that you appropriately rent or purchase regalia.
 - Check CAESAR for any holds on your record. Your diploma and copies of your transcript will not be released if you have any holds.

APPENDIX B

Use of GSTS – the Graduate Student Tracking System

GSTS (gsts.northwestern.edu) is a web portal that collects information on student progress that isn't necessarily in your transcript. The ChBE department currently asks you to use this for six tasks.

1. **Enter your advisor and committee.** The director of graduate study (DGS) will know very well who you have selected for your advisor. However, before your 3rd year, please enter your committee here, where it will be checked for compliance. Your advisor(s) is the chair of the committee, while all other members should be listed as 'committee members'. Please select "completed" only when you have entered your committee.

The system can manage communications between yourself and your committee. We do not currently recommend it for that purpose. There is a special procedure to give GSTS access to non-NU committee members. It is not necessary at this time; please only list their biographical information.

2. **Track your classes.** As a first-year, please indicate how you plan to fulfill your requirements in Transport, Kinetics, Thermodynamics, Department Electives and Other Electives. Once you complete courses, including department seminar and TA credits, please assign them to their respective categories. This is how the DGS will track your progress and check that you have fulfilled needed requirements.

For any students with prior graduate coursework in chemical engineering, administrative notes will be attached here about course waivers or substitutions, as appropriate.

3. **Provide annual evaluations.** The 'academic progress' tab provides places for an annual narrative statement on progress and goals. At the top is a self-evaluation score. Here, you should also describe your research, and keep a running list of awards, papers, honors, meetings, and courses taught. Please upload evidence (papers, award notices, etc). This is very important for personal and department-level tracking.

Your advisor will provide a formal review here late every summer. This should only be the beginning for a more detailed conversation with your advisor(s).

4. **Describe your research project in general terms.** In this tab, please provide a brief, relatively general description of your project. This is helpful for department-level statistics.
5. **Upload other documents.** Both you and the program can (should) upload additional documents. The program will upload any relevant prior transcripts (if courses are being waived), continuation decision letters, the finalized 4th year review form, and potentially others. Students can upload proposal and 4th year review documents and presentations, published papers, and any other relevant work products.
6. **TGS Forms.** Fill out forms related to Milestones: Prospectus Form (simultaneous with Qualifying Exam form), Final Exam Form, Application for a Degree Form.
7. **Communication.** You will receive some email blasts from the DGS via GSTS. We also hope to implement automated reminders about upcoming milestones such as the 4th year review.

APPENDIX C

GSTS user guide

Director of graduate studies: Keith Tyo

Go to <https://gsts.northwestern.edu>. After login, you will find five key tabs. You need to add information to each. A walkthrough is given in this document.

1. Committee (not for 1st years):

- a. Please confirm that your advisor (or co-advisors) are correct.
- b. Add your committee members if you have them.
- c. Please contact the director of graduate studies if you have non-nu committee members.
- d. Slide to 'complete' when done.

2. Plan of study:

- a. Assign courses.
 - i. Click to the right of a course, and select 'transport phenomena', etc.
 - ii. Make sure to hit enter to save the input.
 - iii. 3rd years and above can only assign the core courses and electives.
 - iv. 2nd years can assign everything to a section, including seminar, RCR courses, etc.
 - v. For 1st years, and anyone not having completed their coursework:
 1. Fill out the 'courses planned' sections for each of the key sections (transport, thermo, kinetics, department electives, other electives).
Note: there are a lot of old and incorrect courses in their database. Please only list courses actually offered.
- b. Slide to 'complete' when done.
- c. Communication with the DGS regarding courses will result in a note being appended here.

3. Academic progress: *this is the self-evaluation. This section will be reviewed and approved by your advisor(s), so use appropriate language.*

- a. Write a brief narrative statement emphasizing progress over the last year.
- b. Write a title or short description of your research topic.
 - i. It should be written to demonstrate your understanding to your advisor.
- c. Fill out sections for (cumulative) awards, publications, honors, presentations, and your completed ta assignments.
 - i. This should mirror what is in your cv.
 - ii. You may not have anything for the 'other courses or seminars' section.

- d. Write a brief narrative of your goals for next year, directed at your advisor.
 - e. Annual advisor meeting date
 - i. Agreed upon between you and your advisor previously
 - f. Slide to 'complete' when done.
 - i. **Note:** your advisor may also require additional evaluation forms, which should be uploaded in the documents tab (see below).
4. **Research project (not for 1st years):**
- a. Write a short narrative, accessible to a general chemical engineer.
 - b. Slide to 'complete' when done.
5. **Documents – all must be uploaded as (smallish) pdfs (not for 1st years):**
- a. General:
 - i. If you or your advisor has filled out another type of evaluation, please upload it here for addition to your record.
 - b. Milestones:
 - i. Each upload must correspond to a type of 'record'. These items are at Your discretion.
 - ii. Your proposal, 4th year review, and departmental seminar can go in the 'selection of committee', '4th year review', and 'seminar' records, respectively.
 - 1. Please annotate with the date of these events.
 - c. Plan of study:
 - i. Nothing required, but you may upload important communications from the DGS here, if you wish.
 - d. Academic progress:
 - i. Upload a pdf for any manuscripts you indicated earlier.
6. **TGS forms – essential forms to submit to TGS for approval of milestones**
- a. To submit a new form, select the type of form you want to submit from the "create new form" drop down menu.
 - b. **TGS forms and their uses:**

Form name	Use
Application for degree	Use this form to petition to graduate for a future quarter, indicate the name as it should appear on the diploma, and the address where the diploma should be mailed. The diploma mailing address can be updated even after the form is submitted and approved.
PhD qualifying exam	Submit this form once you have passed the qualifying exam.
PhD prospectus	Submit this form once you have passed the prospectus.
PhD final exam	Submit this form leading up to your dissertation defense.
Petition for absence	Submit this form to request a general or family leave of absence, or a parental accommodation.
Program withdrawal Request	Submit this form to request to withdraw from your graduate program.
Masters in primary PhD	Submit this form to request a master's degree along the way to the PhD in the same program.