University of Notre Dame
Department of Chemical and Biomolecular Engineering

Guide to Graduate Studies
2024-2025

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UNIVERSITY OF NOTRE DAME | CHEMICAL AND BIOMOLECULAR ENGINEERING

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1. Introduction

The University of Notre Dame's graduate degree programs in the Department of Chemical and Biomolecular Engineering within the College of Engineering have as their mission "the development of individuals with the capability to initiate and conduct independent research in chemical engineering and aligned fields and with the preparation to contribute as professionals in those fields."

The management of the program follows five guiding principles:

1. To provide a graduate education that balances strong foundations in chemical engineering principles with an ability to conceive, execute, and report professional-quality research and the development of professional skills.
2. To provide meaningful evaluations and feedback to ensure the timely progress of students.
3. To support timely and appropriate outcomes for all students.
4. To recognize and celebrate excellent performance.
5. To innovate as the needs of the students, the department, and the professional community evolve.

The purpose of this guide is to lay out the general features and specific details of the graduate programs offered by the department. It supplements, but does not replace, the Graduate School Bulletin of Information or the Academic Code of the Graduate School. Graduate School Policy and Procedure Library

This document is maintained and updated periodically by the Director of Graduate Studies (DGS) and the Graduate Academic Program Administrator as the requirements and policies of the program evolve.

2. Requirements of the Ph.D. Programs

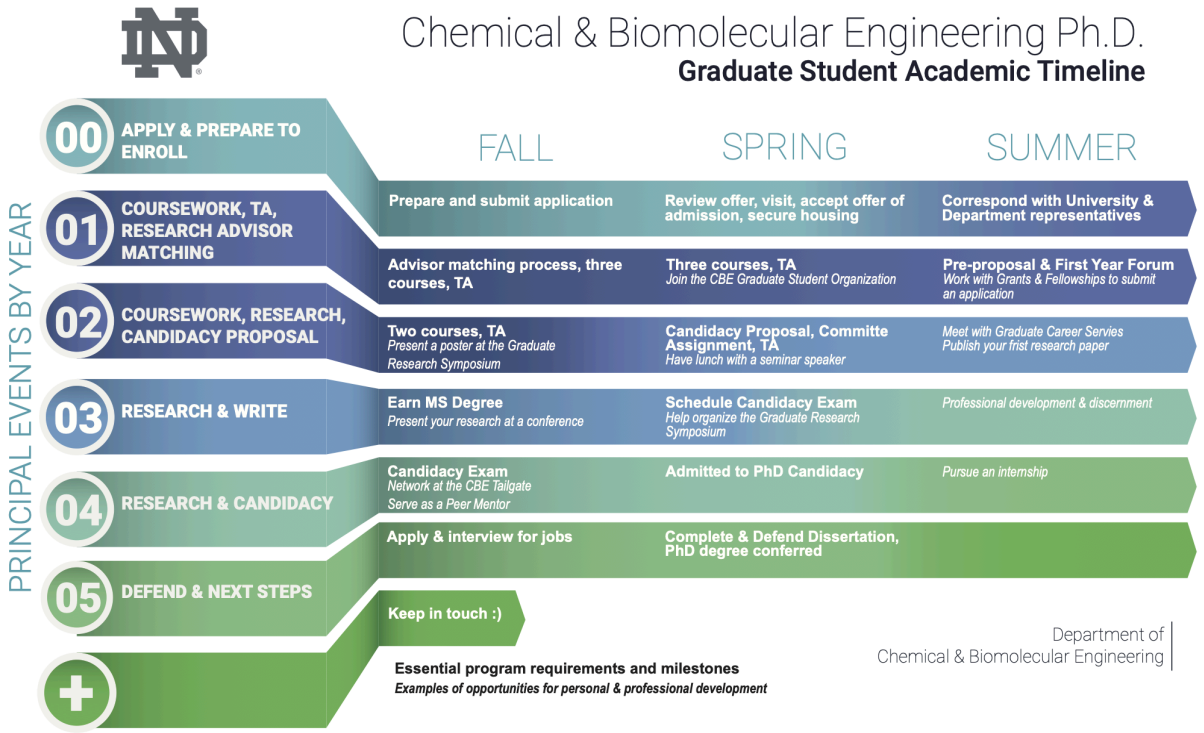


Figure 2.1.1: Typical timing and major events in pursuing a Ph.D. in Chemical Engineering.

2.1. Degrees offered and time to degree

The department offers Ph.D. degrees in Chemical Engineering, Bioengineering, and Chemical Engineering: Materials Science and Engineering. The department admits students with undergraduate or Master's degrees in chemical engineering or closely related disciplines.

The Department's admission's committee admits graduate students to the Chemical Engineering and Chemical Engineering: Materials Science and Engineering Ph.D. programs. Bioengineering admissions are conducted separately by the Bioengineering program, bioengineering.nd.edu/apply.

Time to degree is determined by the progress of the student through the required components of the program and successful completion, and defense, of a dissertation. Exact timing is dependent on the nature of the research undertaken and the rate of the student's academic progress. Typical time to degree is five years.

Spring Admits: Students are typically admitted for and begin their graduate work during the fall semester. Students may occasionally apply for and be admitted for the spring semester. All students are bound by the coursework, teaching service, and research requirements given in the following sections.

2.2. Coursework requirements

The Ph.D. degree in Chemical Engineering requires a minimum of 24 credit hours of graduate-level coursework (course number 6XXXX+, as specified by the Registrar), plus 36 hours of dissertation research (*CBE 68801*, *68901*) and graduate seminar (*CBE 63001*) for a total of 60 credit hours.

There are five required graduate courses that are to be completed during the first academic year:

CBE 60000 First Year Grad Orientation
CBE 60542 Mathematical Methods in Engineering I
or CBE 60258: Advanced Data and Computing
CBE 60544 Transport Phenomena I
CBE 60546 Advanced Chemical Reaction Engineering
CBE 60553 Advanced Thermodynamics

If any of these is not offered during the first academic year, a substitute core course will be designated by the Director of Graduate Studies.

In a typical program, a student will take 3 graduate courses in their first semester, 3 graduate courses in their second semester, and 1 graduate course in each of the following two regular academic semesters.

For the 12 elective course credits, students may choose from any letter-graded graduate-level course offered by the C.B.E. department or, in consultation with their advisor and the Director of Graduate Studies, graduate-level courses from other departments related to chemical engineering principles broadly defined.

Unless offered as a three-credit letter-graded course, a Directed Readings course may not count towards the graduate course requirements.

To maintain full-time status in the graduate program for fall and spring semesters, a student must be enrolled in a minimum of nine (9) credit hours, three (3) of which have to be at the 60000 level or above, per the graduate guide. In any given semester, any or all of these courses can be research credits (CBE 68901 or equivalent). Full time status is necessary, in particular, to ensure there are no issues related to student stipends, benefits, and international student status. Please consult with the Director of Graduate Studies regarding any questions.

2.2.1. Seminar

All graduate students are required to register for *CBE 63001 Graduate Seminar*, for every semester they are in residence within the program. Graduate students are expected to attend all seminars unless

explicitly excused by their advisor and the instructor responsible for the course.

2.2.2. Language requirement

There is no language course requirement for the Ph.D. degree in Chemical Engineering. Students for whom English is not their native language are encouraged to take advantage of the university resources for developing their communications skills. English for Academic Purposes (EAP)

2.2.3. Transfer of credits

Up to 24 graduate credit-hours can be transferred into Notre Dame from a Master's degree completed within the past five years from an institution approved by the department. However, of these credits **a maximum of 12 can be applied towards the 24-credit Ph.D. coursework requirement**. Note that for students who wish to earn a Master's degree as part of their participation in the Ph.D. program, the same class cannot be transferred and applied to both degrees.

Requests for transfer of credit must be approved by the Director of Graduate Studies and must satisfy the Graduate School requirements for credit transfer. The Academic Code of the Graduate School details the transfer of credits policies and process.

The C.B.E. DGS must evaluate courses to determine if they can fulfil any of the four required or four elective courses required in the Ph.D. program. To be eligible for transfer into the CBE program, the student must have earned a grade of at least B (or equivalent) in each elective course, and at least B+ (or equivalent) in each core course.

2.2.3.1. Process for transferring in credit from other institutions

Provide the following documents to DGS for evaluation:

C.B.E. Graduate Transfer Credit Review Request Form (Appendix B)

Copy of the M.S. (or other appropriate) transcript with final course grades

Course syllabus or other official documentation of course content, in English or translated to English

Official graduate transcripts, showing degree conferral date (if applicable), must be on file with the ND Graduate School.

The transfer process can only take place after a student has successfully completed one semester at Notre Dame but usually takes place during the summer at the end of the student's first year.

2.2.4. Minimum grade requirements

For Ph.D. students, graduate course grades awarded within the department have the following interpretation:

A grade of B+ indicates acceptable performance. A grade of B or lower indicates some deficiencies, which, in the opinion of the course instructor, should be remedied if the student continues towards the Ph.D. degree. Grades of B- and lower indicate serious deficiencies. Remedies for deficiencies are typically determined at the beginning of a student's second year (and the end of each semester thereafter) by cognizant faculty in consultation with the DGS. Remedies may include repeating a course, demonstrating proficiency through a B+ or better in a similar course approved by the DGS, or other actions as deemed appropriate by the committee and concurred by the DGS.

All Ph.D. students in the CBE program must maintain a minimum overall GPA of 3.25. Students with a GPAs that fall below 3.25 at the end of any semester will receive a notification from the department. Students who do not demonstrate progress towards meeting the GPA and/or minimum grade requirements will be dismissed from the program.

The department follows the *Extreme Under-performance* guidelines set by the *Academic Code of the*

Graduate School.

2.3. Teaching assistant requirement

Service as a teaching assistant (TA) is a required part of the academic program for a graduate degree in Chemical Engineering. The TA experience contributes to the graduate student's intellectual development and provides valuable exposure to and experience in communicating technical concepts to others. Graduate students, with feedback from their advisors, are encouraged to suggest TA assignments that would be beneficial to their professional development. Final decisions on TA assignments are made by the Director of Graduate Studies and/or the Department Chair.

Students are expected to complete two semesters of TA service at approximately 8 hours/week of effort and two semesters at approximately 4 hours/week of effort. These are typically performed in the first and second years, respectively, though under some circumstances, TA duties may be deferred.

Typical responsibilities include creating solutions to problem sets, grading homework and exams, holding office hours, managing tutorials, supervising laboratory experiments, etc. Instructors use their own discretion in determining how the TA's effort is distributed. Students will receive a written evaluation of their performance as a TA at the end of the semester from the course instructor. These evaluations are one component of the evaluation of the Research Proposal Evaluation.

Because of the potential for conflict of interest and privacy requirements, students may not simultaneously be registered for and be assigned as a teaching assistant for a letter-graded course.

If an unanticipated conflict arises between TA service and other duties, e.g. attending seminar or a class or a lab meeting, the TA, instructor, and advisor will seek to find the best compromise for all parties involved. Ideally, the compromise is worked out by the affected parties, but if necessary the DGS or Chair will intervene to broker a solution.

2.3.1. Graduate instructor

Students who have passed the Research Proposal Evaluation and who desire more experience in the classroom may request to be a graduate instructor with the advice and approval of (1) their advisor, (2) the DGS, and (3)the course instructor. Graduate instructors collaborate with the course instructor, who will be a regular faculty member, in teaching a course. In this advanced position, duties may include development and presentation of lecture materials, leading of discussions, preparation of homework and/or examination materials, or other activities that advance the developmental goals of the graduate student. The faculty instructor will retain responsibility for the content and execution of the course and will be responsible for providing coaching and feedback to the graduate student instructor.

2.4. Research advisor selection and matching

The department endeavors to match each student with a research advisor in the student's first semester of residency. The role of the research advisor is to act as a teacher, guide, and mentor in the performance of independent research. Typically, the research advisor serves as principal investigator on a research grant that is responsible for the student's stipend and benefits. The research advisor assists the student as they progress toward completing their doctoral dissertation. The research advisor aids in the identification of a suitable research problem, provides an intellectual climate and facilities for executing research, and consults with students on a regular basis regarding their plan of study, research progress, and professional development. A significant number of research projects result from collaborations between faculty members. Thus, in some situations, a student may be jointly advised by two faculty members.

The department strives to place every student with their preferred advisor while attending to the availability of projects and funding in any given research group. For students entering the program in the Fall semester, faculty present their available research projects during the *CBE 60000 First Year Grad*

Orientation course meetings. As these presentations are taking place, it is expected that the student will meet with multiple faculty members to discuss their research interests, career goals, and motivations for graduate studies. These presentations and conversations should shape the student's ideas regarding potential advisors. After all of the faculty with open research projects have presented, the student will be required to submit a report that details a ranking of their top three choices. An example of the report assignment detailing the required content and format is provided in Appendix G. The department chair will consider the student's rankings and comments made in the report, along with discussions with the faculty, when matching graduate students with research advisors.

For students who enter the program in the Spring semester, the research advisor matching process follows a similar protocol except faculty present their available research projects in meetings facilitated by the DGS.

2.5. Research progress and support

Students are required to register for *CBE 68901 Research and Dissertation*, during the academic year and *CBE 67980 Independent Summer Research*, during the summer semester to earn research credits which will be counted toward their degree requirements. Students must abide by Graduate School policies regarding maintenance of full-time status. These policies are listed in the *Academic Code of the Graduate School*, which is available on the Graduate School website.

Students are expected to discuss expectations of the research group with their advisor and to seek and act on regular feedback of their performance. Students are expected to complete and discuss with their advisor an annual self-assessment and development plan. Appendix G

Research course grades are recorded as Satisfactory/Unsatisfactory. In cases in which research performance is not satisfactory, the advisor will assign an Unsatisfactory (U) grade and communicate that decision and rationale to the student and DGS. A student who receives a grade of U in two semesters in succession will be dismissed from the graduate program effective immediately.

A student may, at the discretion of the advisor, be dismissed from a research group due to unsatisfactory performance. In this circumstance, the department will provide the student up to three months of support during which time they must identify a new advisor or be dismissed from the graduate program.

2.6. Research Pre-Proposal and First-Year Research Forum

All first-year students (both spring and fall admits) are expected to take part in the Research Pre-Proposal and First-Year Research Forum, which consist of a written report, an oral presentation, and an advisor assessment of the student's performance in research to date. These components assess the ability of a student to function within a laboratory setting, to probe their understanding of the fundamental principles underlying their research, and to evaluate their knowledge related to the broader scope of their project. Feedback on performance, areas of need, and opportunity for improvement will be provided to the student to help prepare the student to perform research at a level consistent with their degree objective. The assessment is normally at the end of the first summer in residence. The assessment is carried out by a committee constituted by the DGS and includes the advisor and at least two other regular faculty members. This committee assembled for this assessment **is not** the dissertation committee.

2.6.1. Research Pre-Proposal

The research pre-proposal consists of a written document whose content should (1) describe the technical objectives as well as the science, engineering, or educational significance of the proposed work, (2) demonstrate an understanding of the fundamental principles and prior literature that form the basis of the proposed research, and (3) articulate a preliminary research plan that justifies the

suitability of the methods to be employed. While preparing the written document, the student may consult with the research advisor but the document must be the work of the student.

Guidelines for preparing the written report are included as Appendix C. The D.G.S. will schedule and notify graduate students of the requirement and expectations of the written report and the due date of the report no less than six weeks before the deadline. The student will provide the written report to the D.G.S. or their designee as a digital file (PDF only) by the specified deadline.

2.6.2. First-Year Research Forum

Research performance will be assessed through a first-year research Forum where students present their research progress to their graduate student colleagues and a committee of faculty members. During the Forum, the student makes an oral presentation, no more than 10 minutes in length, summarising research objectives, preliminary results, and plans. This presentation is followed by a 5-minute period of questions from the audience. The period of questions from the audience is moderated by a designated professor. Attendance and participation in this event is required for all first year graduate students.

Slides used in the oral presentation must be submitted as a **PDF** to the Academic Program Administrator, Carla Siler, csiler2@nd.edu by 8:00 PM on the day prior to a student's presentation . These slides will be made available to the committee for the purpose of assessment and comment..

2.6.3. Evaluation of the Research Pre-Proposal and First-Year Research Forum

Following the presentation at the Forum, the examination committee will discuss and assess the student's performance. The primary evaluation criteria are the student's ability to (1) clearly describe a research objective, (2) demonstrate an understanding of the fundamental principles underlying the research and of the key research literature, (3) articulate a preliminary research plan, and (4) present preliminary results that support the plan. The results of this assessment will be documented in a report that is drafted by the committee to provide constructive feedback to the student. This report will be returned to the D.G.S. The student and advisor should discuss the content of the report as soon as possible following the conclusion of the assessment.

Failure to complete the research pre-proposal or presentation as part of the Forum can be used as grounds for dismissal from the program.

2.7. Dissertation committee

The dissertation committee is charged with providing guidance and oversight on the research progress and professional development of the student. Committees are assigned by the DGS toward the end of the second year of study, in advance of the Research Proposal Evaluation. Typically, the committee will consist of the advisor(s) and three additional members, at least one of whom must be a C.B.E. faculty member.

The student is encouraged to use the Committee as a resource for consultation on research and other dimensions of their Ph.D. program. As such, the student, with input from the research advisor, is encouraged to identify and recommend potential committee members to the DGS. Research collaborators, faculty from other departments, and/or from other universities are encouraged where appropriate. Ultimately, the composition of the committee must conform to the requirements outlined in the Academic Code of the Graduate School.

After the DGS assigns the dissertation committee, the student must contact the assigned committee

members to confirm their willingness and availability to serve on the committee, and scheduled meetings as necessary.

Under some circumstances one of the members of the Ph.D. committee may need to be replaced. The student and research advisor will communicate requested changes to the DGS, who will review and approve as appropriate.

2.8. Research proposal evaluation

Second year students are expected to take part in a research proposal evaluation involving their assigned doctoral dissertation committee. The Research Proposal Evaluation assesses whether a student is prepared to perform research at a level consistent with their degree objective, and to provide feedback that helps to guide the student's research plan and professional development. The evaluation is expected to be completed within 30 days of the conclusion of a student's fourth semester in residence. The student shall identify a date and time mutually agreeable to the advisor and the dissertation committee members and communicate that information to the C.B.E. Academic Program Administrator.

The evaluation includes a review of the student's knowledge of chemical engineering fundamentals, results of the written and oral components of a research examination, an evaluation by the research advisor of the student's performance in research, and an evaluation of the student's performance as a teaching assistant.

Approximately 3 to 5 months before the Research Proposal Evaluation, the DGS or a designated professor will hold an interactive information session regarding the preparation of research proposal materials. All second year students are expected to attend.

The DGS will approve petitions for extension beyond the deadline only under extenuating circumstances. Failure to complete the oral candidacy exam within the designated time frame may result in termination from the Ph.D. program.

2.8.1. Knowledge of chemical engineering fundamentals

The student's knowledge of chemical engineering fundamentals is judged by their performance in graduate courses taken by the time of the Research Proposal Evaluation.

If deficiencies should appear in the coursework evaluation, while the other evaluation components appear satisfactory, specific remedies may be identified on an individual basis at the discretion of the faculty.

2.8.2. Teaching evaluation

Teaching assistantship duties are a required part of the academic program in Chemical Engineering. The evaluation is based on teaching assistant assessments in courses supported up to the point of the evaluation. If deficiencies are noted, a remedial action may be recommended by the committee and communicated to the DGS.

2.8.3. Written Research Proposal Evaluation

The written component of the Research Proposal Evaluation should demonstrate the ability to articulate a well conceived research problem and propose a plan for addressing a handful of clearly articulated scientific hypotheses or research questions. The proposed work should be described in the context of literature and supported by preliminary research data, if available. The student shall prepare their written proposal following the formatting guidelines outlined in Appendix D, which are consistent with the format of a National Science Foundation (NSF) or National Institute of Health (NIH) research proposal.

The document must be the work of the student. While each student is strongly encouraged to discuss their research directions (hypotheses, specific aims, etc.) with their advisor(s), the research advisor(s) must not provide feedback on the written report. The advisor may provide feedback on outlines prepared by the student. Students are encouraged to use prior Research Proposal Evaluations or grant applications as examples, but must not plagiarise.

The document, along with a current *curriculum vitae*, must be distributed to the committee in electronic format and/or hardcopy, as preferred by the committee members, at least one week prior to the oral presentation date.

2.8.4. Oral Research Proposal Evaluation

The oral component of the Research Proposal Evaluation is a closed session presentation by the student to their dissertation committee. . The presentation should make a compelling argument for the proposed research plan in 20 minutes. The presentation should clearly articulate the key scientific questions and guiding hypotheses in the context of relevant scientific literature. Students are encouraged to integrate their current research results as preliminary data to show the proposed research plan is viable. The presentation will be followed with at least 50 minutes of questions and interactive dialogue with the dissertation committee regarding details of the research field, specific objectives, results, and plans.

Prior to the presentation, the committee will review the academic progress of each student. If there are any gaps or concerns (such as, but not limited to, a poor grade in core graduate coursework), the committee may ask detailed questions to ensure each student has the necessary mastery of chemical engineering fundamentals to successfully execute the proposed research. The period of questions from the dissertation committee is moderated by the committee chair. When all questions have been addressed to the satisfaction of the committee, the student is dismissed from the examination for the committee to evaluate the student's proposal holistically, including both the written and oral components of the Evaluation.

The committee will vote following the guidelines prescribed by the Graduate School. The results of this evaluation are documented in a comprehensive evaluation report which provides constructive feedback to the student from the advisor and committee, as well as rationale supporting the committee's decision regarding the evaluation. This report will be returned to the DGS immediately following the examination. The student will receive a copy of the report, and the advisor will discuss the report and outcome with the student as soon as possible after the completion of the examination.

2.8.5. Research Proposal Evaluation outcomes

Results of the Ph.D. Research Proposal Evaluation are reported as a **PASS**, a **RESTRICTED PASS**, a **PASS TO A TERMINAL MASTER'S DEGREE**, or **FAIL**:

1. **PASS** indicates that student performance is judged to be satisfactory in all aspects of the evaluation.
2. **RESTRICTED PASS** indicates that the student has performed satisfactorily in most aspects of the evaluation, but with limited and specific deficiencies. In the case of a RESTRICTED PASS, specific remedies are documented and outlined to the student. If carried through to the satisfaction of the examination committee, the RESTRICTED PASS then reverts to a PASS. If not, the RESTRICTED PASS reverts to PASS TO A TERMINAL MASTER'S DEGREE.
3. **PASS TO A TERMINAL MASTER'S DEGREE** indicates that significant deficiencies exist in performance that jeopardise the student's ability to complete and defend a Ph.D. dissertation. Sufficient performance is indicated to support the ability of the student to successfully complete a Master's degree. The student is moved into the Master's degree program, often with financial

support to complete the Master's thesis within 90 days, and becomes bound by that program's expectations (Refer to Section 3 of this document).

4. **FAIL** indicates that progress towards the student's declared degree objective is unsatisfactory. The student is terminated from continuation in the graduate program.

2.9. M.S. in Chemical Engineering degree for Ph.D. students

A student who has successfully presented and defended their Ph.D. research proposal evaluation, who has completed four semesters in the Ph.D. Program, and who has prepared a qualifying research paper in collaboration with their research advisor, may be eligible to receive a Master's Degree in Chemical Engineering. The paper must describe work in which the student has a primary (not supporting) role, must be submitted to a research journal, and have passed peer review. Documentation of the completion of the peer review process, galley proofs, or published documents will be required to approve conferral of an M. S. degree.

To provide the M.S. degree in a given semester, the student must provide evidence of completing the requirements for the M.S. degree to the DGS at least one week before the deadline for completing Master's degree work published by the Graduate School. The DGS will evaluate and approve requests subject to satisfactory completion of items noted above.

Approved requests will be processed by the Academic Program Administrator and submitted to the Graduate School.

2.10. Ph.D. candidacy examination

Students successfully completing the Research Proposal Evaluation must complete the Ph.D. Oral Candidacy Examination to become a Ph.D. Candidate. The procedures for the Ph.D. candidacy examination are prescribed by the Graduate School. The examination is carried out by the doctoral dissertation committee. In C.B.E., the examination is used to assess a student's preparedness to complete the Ph. D. degree, demonstrating that a student will be able to conceive, propose, execute, document, and defend graduate-level research. The exam also exists as an avenue to provide feedback that guides the student's professional development. The candidacy exam report and presentation should demonstrate significant progress towards addressing the research problem that was presented in the Research Proposal Evaluation, ideally evidenced by the publication of a paper in the appropriate peer-reviewed literature or the completion of a dissertation chapter. The report should detail a plan for successfully finishing Ph. D. research in the subsequent 12-18 months.

Candidacy examinations will occur in the **third or fourth year in residence**, depending on student progress. The Academic Code of the Graduate School requires students to complete their Candidacy Examination by no later than the 8th semester in residence. The student shall identify a date and time mutually agreeable to the advisor and the dissertation committee members and communicate that information to the C.B.E. Academic Program Administrator. The DGS will approve petitions for extension beyond the deadline only under extenuating circumstances. Failure to complete the oral candidacy exam within the designated time frame may result in termination from the Ph.D. program.

2.10.1. Written candidacy report

The written candidacy report should demonstrate the ability to present and defend a well conceived research problem, to demonstrate significant progress towards addressing that research problem, ideally evidenced by the publication of a paper in the appropriate peer-reviewed literature, and a well-defined plan for bringing the research to a successful end. The student shall prepare their written candidacy examination document following the formatting guidelines outlined in the Appendix E.

The document must be the work of the student and must be prepared without the aid of their advisor. While each student is encouraged to discuss their research directions and progress with their advisor(s), the research advisor(s) may not provide feedback on the written report. It should be noted

that the document is allowed to overlap significantly with intended future dissertation chapters, draft publications and previously published work by the student and collaborators (including their advisor).

The document, along with a current *curriculum vitae*, must be distributed to the committee in hardcopy and/or electronic format, as preferred by the committee members, at least one week prior to the Research Proposal Evaluation presentation date.

2.10.2. Oral candidacy examination

The oral candidacy examination is open only to the student and the Ph.D. committee and shall last no less than 90 minutes in total, as required by the Graduate School. It consists of a presentation by the student that shall be approximately 25 minutes. The presentation should detail the key research questions and guiding hypotheses of the research in the context of the relevant technical literature, specific objectives, results generated to date, and a proposal for the work to complete the Ph.D. Following the presentation is a period of questions and interactive dialogue with the dissertation committee on specific details of the research objectives, results, and plans. The period of questions from the dissertation committee is moderated by the committee chair. When all questions have been addressed to the satisfaction of the committee, the student is dismissed from the examination, and the committee goes into discussion.

The committee discusses the performance of the student on both the written and oral components of the examination. The committee will vote following the guidelines prescribed by the Graduate School. The results of this evaluation are documented in a comprehensive examination report. The report will be drafted both to provide constructive feedback to the student from the committee and advisor as well as to support the committee decision regarding the evaluation. This report will be returned to the DGS immediately following the examination. The student will receive a copy of the report, and the advisor will discuss the report and outcome with the student as soon as possible after the end of the examination.

2.10.3. Candidacy examination outcomes

The committee discusses and votes on the outcome of the examination. Collectively the committee reports the results of the Ph.D. Candidacy Examination to the DGS as a **PASS**, a **RECOMMENDED RETAKE**, or a **FAIL**:

Collectively, the committee discusses and votes on the outcome of the examination. Results of the Ph.D. Candidacy Exam are reported as a **PASS**, a **RECOMMENDED RETAKE**, or a **FAIL**:

1. **PASS** indicates student performance is judged to be satisfactory. A pass requires the affirmative vote of at least three of the four committee members. The outcome is reported to the Graduate School and the student may be admitted to Ph.D. candidacy.
2. **RECOMMENDED RETAKE** indicates that the student has not performed satisfactorily in at least one dimension of the examination but evidences the potential to pass the examination. The department chair must approve the retake, and the retake must be completed within 90 days of the original oral examination date. The outcome of the retake must be either pass or fail.
3. **FAIL** indicates that progress towards the student's declared degree objective is unsatisfactory. The student is terminated from continuation in the graduate program.

2.11. Admission to Doctoral Candidacy

After a student has successfully completed the 24 course credits of the Ph.D. Degree and passed their Candidacy Examination they may be admitted to Doctoral Candidacy. The required form will be processed by the Graduate Academic Program Administrator and submitted to the Graduate School.

2.12. Ph.D. in Chemical Engineering degree

Subsequent to a student achieving doctoral candidacy, their successful completion of the Ph.D. degree is

dependent upon preparation and oral defense of a Ph.D. dissertation and must be approved by the advisor and Ph.D. committee following the guidelines published by the Graduate School.

2.12.1. Ph.D. dissertation document

The ultimate product of the Ph.D. program is the Ph.D. dissertation, which is an extensive and comprehensive description of the research performed by the Ph.D. candidate. The dissertation is prepared following the formatting guidelines provided by the Graduate School and will generally include an Introduction chapter that reviews the field of research and introduces the contributions of the candidate, followed by chapters that provide additionally necessary information and describe the distinct intellectual components of the research. These chapters may coincide with and substantially reproduce publications authored by the student, subject to copyright approval by the publishing agency and appropriate citation by the student.

The completed dissertation must be submitted to the Ph.D. committee **at least three weeks prior to the scheduled Ph.D. defense** in electronic format (PDF) and/or hardcopy, as preferred by the committee members, along with a *curriculum vitae*.

The committee members must sign the electronic Reader's Report acknowledging that the research and written presentation are sufficient to defend before the committee. Each committee member should submit their assessment no later than one week before the scheduled Ph.D. defense date. The readers may recommend changes to the dissertation to the candidate.

After the oral defense is passed and changes and corrections recommended by the advisor and committee are incorporated into the final text of the dissertation, the advisor signs and approves the dissertation that is formally submitted to the Graduate School.

2.12.2. Ph.D. oral defense

The Ph.D. dissertation research must be presented and defended in front of the Ph.D. committee. The candidate may schedule the defence with the approval of their advisor. Deadlines for completing the dissertation defence in a given semester are published by the Graduate School. The student is encouraged to discuss the deadlines and to initiate the preparation of necessary forms with the C.B.E. Academic Program Administrator. The candidate shall identify a date and time mutually agreeable to the advisor and the Ph.D. committee members, provide a complete dissertation to the committee following the deadlines described above, and communicate the scheduled date to the C.B.E. Academic Program Administrator. The C.B.E. Academic Program Administrator will advertise the defence to members of the department and assist in identifying a venue for the defence. The DGS shall appoint a chair of the defence committee who is not the advisor.

The Ph.D. defence typically lasts no more than two hours and has an open and a closed component. The open component typically begins with an introduction of the candidate by the advisor, followed by an oral presentation by the candidate. The oral presentation shall provide a summary of the Ph.D. research, including its context, major results, and significance to the field, in a format accessible to the dissertation readers and researchers familiar with the research area. The presentation is typically 30 minutes in length. Following the presentation, the chair of the committee calls for questions from the audience to the candidate. After these questions are complete, the audience is excused.

Additional questioning by the committee is conducted in a closed session. Each committee member will, in turn, ask questions for approximately 10 minutes, ending with the advisor, and if necessary followed by a second round of questions. After questions have been addressed to the satisfaction the examination is completed, the chair excuses the candidate and calls for discussion, followed by a vote of committee members. At least three votes out of four are required to pass the oral defense. The results of the exam will be communicated by the committee to the student and the Graduate School as prescribed by Graduate School policy.

2.12.3. Graduation and Commencement

Students must defend and submit their final dissertation to the Graduate School and complete all other Graduate School requirements before they can graduate. Only three graduation dates occur throughout the year, at the end of the fall, spring, and summer semesters. To be on the graduation list a student must be registered and designate your intentions for the semester while completing Roll Call in the same semester, regardless of when they defended. See the Graduate School website for deadlines and requirements.

3. Requirements of the Master's Degree Program

3.1. Degrees offered

The department offers a Master's degree in Chemical Engineering, which has a thesis requirement that can be satisfied in one of two ways. In either case, a student must be admitted to the department Ph.D. program before beginning coursework towards any graduate degree offered by the program. Subsequently, a Master's degree may be pursued following successful completion of the Ph.D. Research Proposal Evaluation, according to the protocol detailed in Section 2.9, or upon the recommendation of the dissertation committee.

3.2. Credit and coursework requirements

The M.S. degree in Chemical Engineering requires a minimum of 24 credit hours of coursework, plus 12 hours of thesis research (*CBE 68801*, *CBE 68901*) in addition to maintaining enrollment and participation in graduate seminar (*CBE 63001*).

Unless offered as a three-credit letter-graded course, a Directed Readings course may not count towards the graduate course requirements.

3.3. Seminar

All graduate students are required to register for *CBE 63001 Graduate Seminar*, for every semester they are in residence within the program. Graduate students are expected to attend all seminars unless explicitly excused by their advisor and the instructor responsible for the course.

3.3.1. Minimum grade requirements

The department adheres to the requirements published in the Graduate School Bulletin of Information for minimum grade requirements to earn the MS degree. In summary, continuation in and graduation from a graduate degree program requires maintenance of at least a 3.0 cumulative GPA. A student whose semester GPA drops below 3.0 for two consecutive semesters is subject to dismissal, as is a student with less than a 2.5 GPA in any one semester.

Note that these are different from the requirements for a student to maintain status within the CBE Ph.D. program.

3.4. Master's thesis preparation and defense

In the event a student's dissertation committee recommends a masters degree, the student will be expected to devote their full time to thesis research. A thesis based upon their research must be prepared following the Graduate School's formatting guide, which is available from the Graduate School's website. The student and their advisor will propose two committee members from the faculty to serve as thesis readers, and form the MS thesis committee along with the student's advisor. Copies of the advisor-approved thesis are distributed to the readers at least one week in advance of the scheduled date for the oral defense.

Prior to scheduling the oral defense, the student should contact the C.B.E. Graduate Academic Program Administrator to discuss scheduling requirements and to initiate the preparation of necessary forms.

The defense is scheduled within the department for a time mutually convenient for the student and committee members. Once approved, the candidate completes the Graduate School's formal submission process for their final thesis document.

4. Safety

Safety is of paramount importance in all aspects of the department's operation. All members of the department should pay attention to conditions that may result in accidents or unsafe conditions, and actively participate to make the department a safe environment for everyone.

All members of the department should familiarize themselves with the *Laboratory Safety Programs*, including the *Laboratory Safety Manual with Chemical Hygiene Plan*, published by Risk Management. All students are required to successfully complete the mandatory safety trainings before they enter any laboratory on campus, and maintain safety validation throughout the time they are in the graduate program. Failure to maintain safety compliance is grounds for dismissal from the program. Compliance includes wearing personal protective equipment at all times in the laboratory.

In general terms, there are several ways in which graduate students can improve their degree of personal safety. Students should familiarize themselves with the department safety plan. Potential hazards vary greatly among laboratories and individuals. Thus, students should review the standard operating procedures developed for specific tasks in each group, and sign off on these procedures. When starting new procedures, students and their advisors should develop a standard operating procedure that minimizes risk.

Students should also be aware of any potentially hazardous materials that may be in the laboratories. A Material Safety Data Sheet (MSDS) should be available wherever materials are located. should report any unusual sensitivities or allergies to the chemicals handled in the research or instructional laboratories to the advisor or instructor in charge, and appropriate precautions must be taken. For example, this might include the use of respirators, gloves, and hoods when handling particular compounds, or else completely avoiding possible exposure. Regardless of the nature of a hazard, standard personal protective equipment must be worn when entering a laboratory.

Knowledge of appropriate procedures is vital in research and instructional laboratories. Many items of research equipment can be dangerous if not handled appropriately or if not maintained. Examples include, but are not limited to, high-pressure gas cylinders and regulators, high temperature furnaces, flammable or hazardous compounds, machinery, electrical equipment, and lasers. It is essential that students be familiar with the proper operation and maintenance of research equipment, as well as the handling of hazardous compounds. This is an area where graduate students must exercise prudent judgement. If a student does not believe they have the knowledge or training to perform their research in a safe manner, they must talk to their advisor before engaging in any research activities. Students should carefully follow established standard operating procedures.

Frequent safety discussions with an advisor and other members of the group will help maintain a culture of safety.

Emergency phone numbers are posted by telephones in laboratories and offices. A list of hazardous materials and unattended experiments should be posted on the laboratory door with phone numbers for emergency personnel to contact when the need arises.

5. Financial support

The department typically provides stipend support during the first two semesters of residency. After this time, the advisor is expected to provide for ongoing support throughout the completion of the thesis or dissertation research, assuming the student maintains full-time status and satisfactory progress is being made.

When a student is admitted with financial support (e.g., as part of an externally-funded fellowship),

assuming satisfactory progress and with the approval of the advisor, every effort is made to continue financial support until the thesis is completed. Funding beyond six years requires approval by the department chair.

Satisfactory progress means that the student continues to maintain the minimal grade requirements and meets the deadlines for the indicated degree objectives. In particular, financial support may be suspended if the deadlines for milestone evaluations and exams are not met.

When stipend is paused, you may be financially responsible for insurance subsidy and tuition.

The date for completing thesis or dissertation research is decided jointly by the advisor and the student, typically 2 to 3 months in advance of the date of the thesis defense. If financial support should terminate before that date, then the advisor provides the student a three-month written notice in advance of the anticipated termination date for financial support. All stipend termination dates are to be shared with the Academic Program Administrator immediately after they are made.

5.1. Internships

Students are expected to work full time through completion of their graduate degree. They may not hold jobs off campus or engage in activities that significantly deter from their full time duties as graduate students.

The C.B.E. graduate program allows and encourages students to pursue internships or similar extended leave opportunities that contribute to their educational and professional development. Leaves must be approved by the advisor, and the Academic Program Administrator must be notified of the leave directly after the advisor approves. Students who receive a salary or stipend from the internship host institution may not simultaneously receive their graduate stipend.

5.2 *Leaves of absence and medical separation of academic duties*

Students requiring an extended leave due to personal or family circumstances should consult the leave of absence policies of the Graduate School.

6. Vacation

Each graduate student is eligible to take two weeks (ten business days) of vacation during each twelve-month period, in addition to University holidays of: Thanksgiving, Christmas Eve through New Years Day Celebration, Good Friday through Easter Monday, Memorial Day Observance, and Independence Day (list is subject to change). Students are required to consult in advance with their advisors regarding specific days that they wish to take as vacation so that research can progress in a planned and coordinated manner.

If for unanticipated reasons a student must be away for time greater than allowed by the vacation policy, their stipend may be paused at the discretion of the advisor and in consultation with the DGS.

7. Health insurance

All graduate students are required to carry health insurance and are automatically enrolled in the Notre Dame student insurance plan unless proof of comparable coverage with an American-based insurance company is provided. See complete requirements along with information related to how the subsidy for the health insurance premium is administered, and health insurance coverage for student dependents on the University Health Services website.

If the student's stipend is ended before May 15, students may be responsible for the remaining premium amount of the policy term (Aug 15-Aug 14). Please see Academic Program Administrator with any questions.

8. Grievance procedures

In the event that a student has an unresolved complaint or grievance with the Department, they may appeal in writing to the Department Chair and/or the Director of Graduate Study (DGS). The procedures and policies for documenting a complaint or grievance are documented in the academic code for graduate school. If the grievance is related to dismissal from the graduate program, then the student must file the written appeal within 14 days from the time notified of dismissal. To hear the appeal, the Department Chair will appoint a committee of three faculty members, who are unconnected factually with the case or the reasons for appeal, to investigate the complaint. If both the Department Chair and DGS are involved in the case, then the Dean of the College, or their designee, will appoint the committee. The person who appoints the appeals committee will also designate a chair for the committee.

The student's statement should indicate details on the nature of the problem, the date(s) the problem occurred, the grounds upon which the appeal is based, background information that the student considers important, and the relief requested.

The appeals committee will promptly and thoroughly investigate the appeal to determine whether the relief requested is warranted. The investigation may include interviews and/or written statements from the student, any student witnesses, faculty or staff members who may be able to provide pertinent information about the facts, as well as a review of any pertinent documents. In most situations, the appeals committee will complete the investigation in 30 business days (business days do not include weekends or employee holidays as recognized by the University). There may be some reports that cannot be investigated within 30 business days. In such cases, the chair of the appeals committee will communicate to the student that the investigation is going to take longer than 30 business days and will also include a statement indicating when the committee anticipates completing the investigation. The chair of the appeals committee will notify the student in writing of the decision of the committee.

If a student is unsuccessful in resolving a complaint at the department level, the student may choose to appeal to the Dean of the Graduate School, who will make a final determination. The student should not make such an appeal until after exhausting available procedures within the department. The Graduate School's grievance process can be found at:
http://graduateschool.nd.edu/assets/9047/info_appeal_procedure.pdf.

Issues of sexual or discriminatory harassment or disability-related grievances will be handled according to procedures outlined in *du Lac: A Guide to Student Life* at https://dulac.nd.edu/. Issues of academic fraud will be handled according to procedures outlined in the 'Academic Integrity' section of the Graduate School Bulletin at https://graduateschool.nd.edu/policies-forms/forms-policies-procedures/.

Appendix A: MVGP

Mission

Offer a graduate program that provides lifelong skills for Ph.D. professionals while supporting the research and educational missions of C.B.E..

Vision

An ND C.B.E. graduate program known for innovation and excellence in graduate education, as evidenced by placing Ph.D. students in top academic and industrial positions.

Guiding principles

Graduate education that balances chemical engineering principles, ability to conceive, execute, and report academic-quality research, and development of professional skills

Processes that ensure timely progress, meaningful evaluation and feedback

Timely and appropriate outcomes for all students

Recognize and reward exceptional performance

Embrace program innovation in the pursuit of Mission and Vision

Appendix B: Graduate transfer credit review request

C.B.E. Ph.D., Graduate Transfer Credit Review Request

Name: ______ND ID number: _____

Up to 12 credits from graduate courses taken at other institutions can be used to fulfil C.B.E. Chemical Engineering PhD requirements.

Step 1)
Include all courses you would like transfer credit to fulfil

Institution where credits were earned: _____

Institution Location: _____

ND Course number +(eg. *CBE 6XXXX*) of required course **or CHEG PhD elective**	**Other institution's course number and name**	**Grade**	**Credit hours**	**Year Credit was earned**

Step 2)
Attach a copy of the course syllabus and the course catalog description for each course you are seeking to fulfil course requirements with.

Step 3)
Email form and attachments to the graduate academic program administrator,
Carla Siler at csiler2@nd.edu.

Step 4)
Official Transcripts: If not already on file with the Graduate School, have official transcript sent to Maureen Collins, 502 Main Building, Notre Dame, IN 46556

Appendix C: Guidance for written pre-proposal report

The purpose of the written pre-proposal report is for the student to demonstrate the ability (1) to describe the technical objectives as well as the science, engineering, or educational significance of the proposed research, (2) to demonstrate an understanding of the fundamental principles and prior literature that form the basis of the proposed work, and (3) to articulate a preliminary research plan that justifies the suitability of the methods to be employed. The document should focus on describing details of the proposed research, including how it is innovative, how it could increase the scientific and technical state of the art, and its potential impact. While preparing the written document, the student may consult with the research advisor but the document must be the work of the student.

Formatting requirements

The written pre-proposal is limited to five (5) total pages; two (2) pages for technical content, one (1) page of references, one (1) cover page, and a one (1) page addendum as discussed below. Evaluators will only review the cover page, up to two pages of technical content, the references, and the one-page addendum. The report will be judged in part based on its legibility and professional appearance.

- Pre-proposal reports must be in the following format:
- Page Size: 8 ½ x 11 inches
- Margins – 1 inch
- Spacing – single
- Font – Times New Roman, 11 point
- No more than six lines of text per vertical inch

Combine all files into a single PDF before submitting. The PDF should be entitled, "student last name_student first name_advisor last name_pre-proposal"

Report contents

1. Cover page (not to exceed one page):
   1.1. The cover page shall include at a minimum: title of the pre-proposal project, name of the student, name of the research advisor(s), and the date.
   1.2. The cover page should also include a brief one sentence statement discussing the scope of the objectives outlined in the pre-proposal. For example, are the objectives associated with the first manuscript, for work to be completed by the Research Proposal Evaluation examination, etc. The decision regarding the scope of the objectives should be discussed with the research advisor.
2. Technical narrative(not to exceed two pages):
   2.1. Figures and Tables

   Figures and tables must be included within the narrative and located as near as possible to the place you first refer to it. Figures and tables must conform to good presentation standards and include a descriptive caption.

   2.2. Motivation

   A detailed discussion of the effort's technical research objective (e.g., key problems to be addressed, theories proposed) and its relationship to similar research undertaken by others to date. This should help to establish the state of the art in the field of research. Cite leading references and provide full citations in the References Cited section.

   2.3. Proposed Aims and Research Approaches

   Proposed research aims - Indicate and justify a research plan (i.e., a collection of proposed aims) to attain the stated research objectives. Where necessary indicate the important differences with previous work in or outside of your group.

Research Approaches - Summarize the methods or theories to be used within the proposed research aims. For experimental work, this discussion may include a description of relevant instrumentation, procedures, and quantities to be measured. Similarly, for computational or theoretical work the plan will include a description of relevant models, necessary computational resources, quantities to be computed, and validation plans.

Also, include the nature and extent of the anticipated results. Describe the significance of the anticipated results by indicating the manner in which the work will contribute to the technical and scientific research area and how these contributions would be demonstrated.

3. References cited (not to exceed one page): References should be cited using a formation that is consistent with the formatting requirements of an appropriate American Chemical Society journal. Include the reference title and doi for each cited work.
4. Addendum: career objectives (not to exceed one page): Provide a brief (~1 paragraph) summary of your career objectives.

Appendix D: Guidance for written research proposal report

The purpose of the Research Proposal Evaluation is to assess whether a student is prepared to perform research at a level consistent with their degree objective and to provide feedback that helps to guide the student's research plan and professional development. The written Research Proposal Evaluation report should demonstrate the ability to articulate a well-conceived research problem and propose a plan for addressing a handful of clearly articulated scientific hypotheses or research questions. The proposed work should be described in the context of literature and supported by preliminary research data, if available. The document should focus on describing details of the proposed research, including how it is innovative, how it could increase the scientific and technical state of the art, and its potential broader impacts.

Formatting requirements

1. The written Research Proposal Evaluation is limited to twenty-five (25) total pages; up to fifteen (15) pages for technical content, up to seven (7) pages of references, one (1) cover page, a one (1) page project summary, and a one (1) page career objectives addendum as discussed below. Evaluators will only review the cover page, the project summary, up to fifteen pages of technical content, the references, and the one-page addendum. The report will be judged in part based on its legibility and professional appearance.

2. Research Proposal Evaluation reports must be in the following format:

- Technical Narrative Word Limit: 3500 words, excluding figures, tables, equations, and references. The word count is entered at the end of the proposal narrative
- Page Size: 8 ½ x 11 inches
- Margins – 1 inch
- Spacing – 1.5
- Font – Times New Roman, 12 point
- No more than six lines of text per vertical inch

3. In addition to the Research Proposal Evaluation report, the student should submit a current curriculum vitae.

4. Combine all files into a single PDF before submitting. The PDF should be entitled, "student last name_student first name_advisor last name_Research Proposal Evaluation"

Report contents

1. <u>Cover Page (not to exceed one page)</u>:
   The cover page shall include at a minimum: title of the proposal, name of the student, name of the research advisor(s), and the date.

2. <u>Project Summary (not to exceed one page)</u>:
   The project summary should be informative to other persons working in the same or related fields. The content in the summary should be written in terms that are understandable to a broad audience within the scientific domain. The summary should be written in the third person. The summary should describe three main topics regarding the proposal: (1) an **overview** including a description of the key research activities and a statement of objectives and methods to be employed. (2) a statement on the **intellectual merit** of the proposed activity describing the potential for the proposed research activity to contribute to the advancement of technical knowledge within the field of study. (3) a statement on the **broader impacts** of the proposed activity describing how the proposed research has the potential to benefit society and

contribute to the achievement of specific, desired societal outcomes.

3. Technical Narrative (not to exceed fifteen pages):

3.1 Overview and Objectives

Provide a clear statement of the work to be undertaken as well as its technical research objective (e.g., describe the context and key problems to be addressed, theories proposed). Discuss its relationship to similar research undertaken by others to date and explain how the proposed work will advance the present state of knowledge. This section should include at least a few sentences to motivate the societal importance of the technical research. A potential organization is to (1) start with the broader societal impact and problem, (2) describe state of the art methods and theories, (3) identify 1 to 3 major gaps in current knowledge, and then (4) articulate how your proposed research will help address these gaps.

3.2 Background

This should help to establish the state of the art in the field of research, including previous and current work in the student's research group. Cite leading references and provide full citations in the References Cited section.

3.3 Research Plan

Proposed Research Aims and Approaches - Indicate and justify a research plan to attain the stated research objectives. Research plans should be organized into a few proposed aims, each with clearly identified expected outcomes. Students are encouraged to integrate their current research results as preliminary data to show the proposed research plan is viable.

Summarize the methods or theories to be used within the proposed research aims. Where necessary indicate the important differences with previous work in or outside of your group. For experimental work, this discussion may include a description of relevant instrumentation, procedures, and quantities to be measured. Similarly, for computational or theoretical work the plan will include a description of relevant models, necessary computational resources, quantities to be computed, and validation plans. Discuss potential shortcomings or risks of the proposed approaches and alternative experiments.

Anticipated Results - Include the nature and extent of the anticipated results. Describe the significance of the anticipated results by indicating the manner in which the work will contribute to the technical and scientific research area and how these contributions would be demonstrated.

3.4 Broader Impacts

This section should include at least a few sentences to motivate the societal importance and potentially broader impacts of the technical research. These broader impact sentences should be written at a level accessible to freshman engineering students.

3.5 Figures and Tables

Figures and tables must be included within the narrative and located as near as possible to the place you first refer to it. Figures and tables must conform to good presentation standards and include a descriptive caption.

3.6 Schedule of Results

The report should include a Gannt chart to summarise the timing of the proposed research including the approximate completion of journal publications and/or thesis chapters.

4. References (not to exceed seven pages):

References should be cited using a format that is consistent with the requirements of the American Chemical Society style guide. Include the reference title and DOI for each cited work.

5. Addendum: Career objectives (not to exceed one page):
Provide a brief summary of your career objectives. In answering this question, you are encouraged to contemplate your motivations for pursuing graduate studies in chemical engineering, what you would like to accomplish during your time as a graduate researcher and student, and how these accomplishments and the skills you develop during your graduate training will help you transition to a fulfilling career. Please also discuss what professional development activities, technical enrichment, and discernment opportunities you would like to participate in during your graduate career.

Appendix E: Guidance for written candidacy exam

The purpose of the candidacy exam is to assess whether a student is performing research at a level consistent with their degree objective and to provide feedback that helps to guide the student's dissertation and professional development. The written candidacy exam should demonstrate significant progress toward addressing the research problem presented in the research proposal evaluation. Growing from the research proposal evaluation, the work should be described in the context of literature and supported by preliminary research data, published papers, manuscript drafts, or completed dissertation chapters. The document should describe the broader context and distinct intellectual components of the student's research contributions and detail a plan for bringing the research to a successful end in the subsequent 12 to 18 months.

Formatting requirements

1. The written candidacy exam is limited to twenty (20) total pages, excluding appendices; up to ten (10) pages for technical content, up to seven (7) pages of references, one (1) cover page, a one (1) page project summary, and a one (1) page career objectives addendum as discussed below. Evaluators will only review the cover page, the project summary, up to ten pages of technical content, the references, the one-page addendum, and the appendices. The report will be judged in part based on its legibility and professional appearance.

2. Research Proposal Evaluation reports must be in the following format:

    - Technical Narrative Word Limit: 2500 words, excluding figures, tables, equations, and references. The word count is entered at the end of the proposal narrative
    - Page Size: 8 ½ x 11 inches
    - Margins – 1 inch
    - Spacing – 1.5
    - Font – Times New Roman, 12 point
    - No more than six lines of text per vertical inch

3. In addition to the Research Proposal Evaluation report, the student should submit a current curriculum vitae.

4. Combine all files into a single PDF before submitting. The PDF should be entitled, "student last name_student first name_advisor last name_Candidacy_Exam"

Report contents

1. <u>Cover Page (not to exceed one page)</u>:
   The cover page shall include at a minimum: title of the report, name of the student, name of the research advisor(s), and the date.

2. <u>Project Summary (not to exceed one page)</u>:
   The project summary should be informative to other persons working in the same or related fields. The summary should be written in the third person and in terms that are understandable to a broad audience within the scientific domain. The summary should describe three main topics regarding the proposal: (1) an **overview** including a description of the overall project objective, the key research activities that have been brought to fruition, and those that remain for completion of the dissertation. (2) a statement on the **intellectual merit** of the proposed activity detailing how the research activity contributes to the advancement of technical knowledge within the field of study. (3) a statement on the **broader impacts** of the proposed

activity describing how the research has the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

3. Technical Narrative (not to exceed ten pages):

3.1 Overview and Objectives

Provide a clear statement of the technical research objective. Discuss its motivation in the context of the state of the art in the field, how the research contributes to advancing knowledge in the field, and the broader societal importance of the research. Cite leading references and provide full citations in the References Cited section. This section should provide an overview/outline of how the proposed and completed research aims will be organized into the chapters of a dissertation. The student may optionally include draft titles for dissertation chapters and 3 to 5 bullet points summarizing the main contributions of the chapter, similar to the "highlights" accompanying research articles in many journals.

3.2 Significant Results and Research Accomplishments

This section should summarize the significant results and research accomplishments achieved by referring to published papers, manuscript drafts, or finished dissertation chapters, which are included as Appendices to the report.

3.3 Research Plan

Research Aims and Approaches - Indicate and justify a plan to successfully attain the overall research objective. The plan should focus on the proposed research aims that remain to be completed for the dissertation. Students are encouraged to integrate their research results and preliminary data to show the proposed research plan is viable.

Modifications to the research plan outlined in the written research proposal evaluation should be discussed in this section. These changes can be used to motivate alternative experiments and/or approaches that are being pursued.

Summarize the methods or theories to be used within the proposed research aims. Each aim should have a clearly identified anticipated outcome. Where necessary indicate the important differences with previous work in and outside of your group. Discuss potential shortcomings or risks of the proposed approaches and alternative experiments.

Anticipated Results - Include the nature and extent of the anticipated results. Describe the significance of the anticipated results by indicating the manner in which the work will contribute to the technical and scientific research area and how these contributions would be demonstrated.

3.4 Figures and Tables

Figures and tables must be included within the narrative and located as near as possible to the place you first refer to it. Figures and tables must conform to good presentation standards and include a descriptive caption.

3.5 Schedule of Results

The report should include a Gannt chart to summarize the plan for bringing the research to a successful end in the subsequent 12 to 18 months including the approximate completion of journal publications and dissertation chapters.

3.6 Appendices

Published papers, manuscript drafts, and completed dissertation chapters should be included with the report as Appendices. These appendices should be referenced at appropriate points to support statements made throughout the written candidacy exam. Students should list all research presentations on their CV but not include presentation

materials as Appendices.

4. References (not to exceed seven pages):
References should be cited using a format that is consistent with the requirements of the American Chemical Society style guide. Include the reference title and DOI for each cited work.

5. Addendum: Career objectives (not to exceed one page):
Provide a brief summary of your career objectives. In answering this question, you are encouraged to contemplate your motivations for pursuing graduate studies in chemical engineering, what you would like to accomplish during your time as a graduate researcher, and how these accomplishments and the skills you develop during your graduate training will help you transition to a fulfilling career. Please also discuss what professional development activities, technical enrichment, and discernment opportunities you would like to participate in.

Appendix F: Departmental graduate awards

1. Outstanding Paper

The Outstanding Paper Award is given annually in the spring semester to recognize a graduate student for a particularly significant or impactful piece of work published in the prior calendar year. The award is open to all graduate students who have first-authored a paper in that year. Students self-nominate but are encouraged to discuss their nomination with their advisor. The nomination package will include the full citation of the paper, the paper itself, a brief (one paragraph) statement of the significance of the work, and the student's specific intellectual contributions to conceiving, executing, and documenting the research. Nominations are typically due in December.

A committee appointed by the Department Chair and consisting of at least three faculty who are not affiliated with the nominated works will select the Outstanding Paper from the eligible submission. The recipient will be invited to present their work at a regular seminar in the spring semester and will receive an award set by the department chair recognizing their accomplishment.

2. Outstanding Dissertation

The purpose of the Outstanding Dissertation Award is to recognize a graduate student for an outstanding level of research accomplishment throughout the pursuit of their Ph.D., including originality, quality, and impact of work, to include number and quality of research papers and professional presentations. The Awardee is typically selected in February from among dissertations submitted within a given academic year, to include August, December, and May graduation dates. Nominations by advisors are provided to the Department Chair or their designee and are to include a student *curriculum vitae* and nomination letter. The chair shall appoint a committee of at least three faculty, excluding any advisors of the nominated students. The committee shall make a recommendation to the chair. The awardee will be recognized with a plaque and monetary award. The department shall endeavor to advertise the awardee and their accomplishment to departmental constituencies.

The Outstanding Dissertation Award winner will generally also be the departmental nominee for the college-wide Shaheen Award.

Appendix G: Example advisor matching report assignment

First Year CBE Graduate Student Orientation Course

Advisor Matching Report
Due 10/20/2022 by 5 PM

Dear First Year CBE Graduate Students:

Identifying an advisor to guide your doctoral dissertation research is one of your most important assignments this semester. Over the past several weeks, you have begun to hear presentations from potential research advisors within the department detailing ongoing research efforts in their groups as well as their mentoring styles. It is expected that you will meet with multiple faculty to discuss your research interests, career goals, and motivations for graduate studies in more detail. These presentations and conversations should be shaping your ideas regarding potential faculty advisors within the department.

As part of your research orientation course, you are required to turn in a report that summarizes your ranking of potential research advisors as well as your rationale for this ranking. **The report will be due on Friday, October 20th at 5 PM**. Please email your report to Carla Siler (csiler2@nd.edu) prior to that deadline. The report should be a two-page, double-spaced document in 12 pt Times New Roman font with 1" margins. Thus, the report will be ~600 words in length. Your report will need to detail a ranking of your top three potential faculty advisors. You **MUST list and rank 3 different potential advisors**. For each potential advisor, you should write a summary of the things that attract you to that research group. Topics to consider in this narrative may include but are not limited to:

- Your interest and personal motivation for pursuing the research that is being conducted by a specific group.
- Potential specific research projects that you may work on and their alignment with your future career goals.
- Mentoring style of the faculty advisor and their ability to help you develop as an independent, creative researcher.
- The team dynamics of the researchers within the group.
- Prior contact and interactions with the potential advisor.

The department chair will consider your rankings and comments, along with discussions with the faculty, in developing research group assignments, with the target of completing assignments by the middle of March. A failure to complete this document fully as described will result in your preferences not being considered until the document is completed correctly. This delay could impact your placement negatively so please take the time to construct this document in a mature and thoughtful manner. Please feel free to reach out to me (wphillip@nd.edu) if you have any questions regarding this document.

Sincerely,
William Phillip
Director of Graduate Studies

Appendix H: Self assessment and individual development plan

Graduate Student Self-Evaluation and Development Plan

Personal Information

Name: <<Student name>> Starting term/year: <<Starting term and year>>

Advisor: <<Research advisor name>> Academic year covered: <<Academic year covered>>

Research Accomplishments, Publications, and Presentations

Research accomplishments over current period

(1-2 pages, single space, 11 pt font, on main accomplishments over current period. Include pictures/graphs/tables and references as appropriate. Write in a way that could be used in an extended abstract. Write carefully and logically; it should be understandable to someone outside your research group.)

A PDF of the research accomplishments document written by <<Student name>> can be found at the following link: <<Research accomplishments>>

Presentations

Presented (Include title, date, meeting or location, and abstract.)
<<Presentations and posters presented>>

Planned (Include title, date, meeting or location, and abstract.)
<<Presentations and posters planned>>

Publications

Published (Include full citation and DOI link.)
<<Published papers>>

CBE Outstanding Paper self-nomination
<<CBE Outstanding Paper self-nomination>>

Submitted and/or In preparation
<<Submitted papers and/or papers in preparation>>

Fellowships and grants

<<Fellowships and grants>>

Honors and awards

<<Honors and awards>>

Coursework

Courses taken

<<Courses taken>>

Courses TA'ed

<<Courses TA'ed>>

Service

Group Service

<<Group service>>

Departmental Service

<<Departmental service>>

University and Community Service

<<University and community service>>

Future Plans

Specific Research Plans

<<Specific research plans>>

Graduation Plans

<<Graduation/departure plans>>

Career Plans

<<Career plans>>

Overall Personal Evaluation

In 2+ paragraphs, reflect on your professional development and research progress. Are you on track for the next milestone in the degree program? Do your activities align with or help to advance career goals? What are your professional strengths and weaknesses?
When considering your professional growth, keep the following categories in mind:

1. Technical skills (ability to use laboratory equipment/computer systems proficiently, efficiently, and productively)
2. Presentation skills (ability to effectively communicate your research results in oral and written formats)
3. Depth of technical knowledge (knowledge of your specific project and area, familiarity with relevant literature)
4. Breadth of technical knowledge (knowledge of areas outside your project, familiarity with general literature)

5. Creativity (developing new ways to solve specific problems in the lab, developing new project ideas, combining your research with other group members in a collaborative way, pushing science forward)
6. Work Ethic (time spent on research tasks, thinking about data or scientific literature, priority of graduate school.)
7. Efficiency/Productivity (efficient use of time, ability to multi-task, time management)
8. Independence (thinking critically for yourself and solving problems on your own; knowing when to ask for help)
9. Leadership (helping other group members; taking charge of things that need to be done without being asked; setting a good example for undergraduate researchers)
10. Teamwork (good group citizen, helping and supporting others)

<<Personal evaluation>>

After reflecting on your professional development and research progress, rate your overall performance. Intermediate scores are permitted.

Poor	Fair	Good	Very Good	Outstanding

<<Overall performance score>>

Student CV

A PDF copy of <<Student name>>'s CV can be found at the following link:
<<Please provide a copy of your CV as PDF>>

Advisor Feedback

Comments on student performance: areas of strength and opportunities to improve.

Appendix I: End of Term Advising Report

End of Term Advising Report

Student: <<Student First Name>> <<Student Last Name>> Date: <<Timestamp>>

Advisor(s): <<Advisor Name>>

Since the last advising report, student performance was:

<<Excellent>>

<<Satisfactory>>

<<Unsatisfactory>>

Is the student on pace to receive a PhD in a 5-year time frame?

More specifically, if the student is...

Pre-candidacy: Is progress being made toward defining research directions and formulating a plan for dissertation work to be presented at the Candidacy Exam?

Post-candidacy: Does the student have a clear plan for dissertation work going forward, in light of progress so far since the Candidacy Exam and last advising report?

If not, what needs to occur to expedite progress?

<<Advisor Comments>>

The submission by September 1 should include the completed Annual Graduate Student Self-Evaluation, including advisor feedback. Is the self-evaluation included this term? <<Is the self-evaluation included this term?>>

In the event of unsatisfactory progress or expressed concerns, a Research Committee meeting may be convened or other action taken by the department.

Appendix J: Travel Expense Report Guidelines

Expense reimbursement for CBE grad students travel

You can prepare your reimbursement report yourself or make arrangements to sit or Zoom with Carla or Pam if you'd like help. We recommend you start your report immediately after you create your first expense, often the flight or conference fees and complete it within 30 days of your travel.

The official **Notre Dame Travel and Expense Policy has many pages & lots of info. We have summarized some helpful info for you below.**

Booking flights and hotels in Concur/TravelND is the university preferred method.

Before you start, you will need:

- ☐ Get FOAP from your advisor, this is where the money for the reimbursement will come from.
- ☐ Get the Student Business Travel Certification Form signed by your advisor, upload to your report as a receipt.
- ☐ For *international* travel: ND International Travel Registration.
- ☐ Receipts (in English) for travel to airport, parking, uber, hotel, flight
- ☐ Meals - university advises that "per diem" is used for all travel (negating the need for food/beverage receipts). Some conferences or meetings include meals & must be accounted for in per diem.
- ☐ Conference or meeting agenda

Required Elements for Full-Trip Documentation

Who:
In the expense comments, include the names of who you roomed/carpooled with if you are splitting expenses or not claiming expenses because the other person paid. If you paid for a meal with guests, you will list the guests. If you carpooled, you will list the guests.

What:
Conference or meeting agenda needs to show the name of the conference, location, and dates. Agendas will be used to check per diem, if meals are included in conference registration. Upload the agenda just like a receipt, but be conscious of how many pages - try to only upload pertinent documents!

Where:
Where did you go & where did you stay/sleep? Your conference or meeting agenda and hotel/lodging receipts will document this.

When:
Expense reports must be submitted within 60 of returning from the trip or 25% of your money will be withheld as income taxes. Travel reimbursement from federal grants could be denied if the request exceeds 90 days from travel.

Why:
Business purpose of the trip; can be as simple as “travel to FL for annual AICHE meeting.”

How:
How you got there, including travel to & from airports or airport parking and Uber or public transport while at the location.

- Airfare.
    - Receipt needs to include the amount paid, itinerary, and traveler’s name.
    - If you booked through Anthony Travel, use expense type “Airfare Domestic/International Paid by FOAPAL”. You should also include the itinerary/receipt.
- Rental car
- Personal car mileage
- Uber or public transportation receipts**.**
    - **Please include the math if you are only using one line for transportation & adding up multiple receipts. Lyft has a summary feature.**
- Or a note explaining you:
    - Carpooled and are not seeking reimbursement because another traveler paid (Specify them by name).
    - Rented car from ND Transportation that was billed to FOAP.
    - Will not be seeking reimbursement for transportation.

Prepaid expenses
See T&E Policy P. 9 for details on documenting prepaid travel expenses in subsequent expense reports. Conference fees or flights are examples of prepaid expenses.

Unclear Situations & Personal Travel
For irregular situations, please use the comment sections to fully explain what went on. You can comment in a line-item or use the general comments section which are reviewed first. Ask the CBE staff (Carla or Pam) for help if unsure how to proceed.

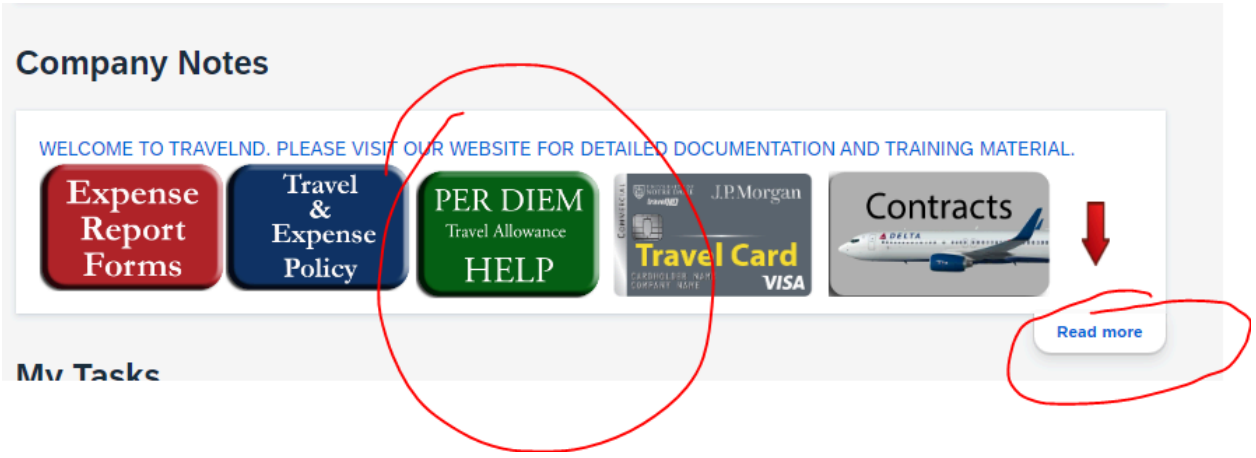
Personal Travel
If you travel for a conference and stay in the location for an extra day or go visit friends, this is considered personal travel. The university doesn’t pay per diem or lodging for personal travel and it needs to be documented in the comments and itemized. Some grants are very particular about how personal travel is reported, so if your advisor is reimbursing you from a grant you might have to completely separate out your personal travel expenses. This is not very common but it is important.

Receipts
Actual receipts are required for all expenses. If you lost a receipt, the missing receipt affidavit is required. All receipts must be in English for domestic travel.

A “transaction detail” capture from your online credit card portal does not count as a receipt.

Receipts should show Paid $XX.XX, amount billed and $0.00 due, or something to indicate the amount and that it was paid. An invoice is *not* a receipt unless it shows what has been paid.

Per Diem



The links to training are right on the travelND home page. The links will take you directly to forms (missing receipt, student travel), T&E Policy document, Per Diem instructions and information on the discount programs and contracts with travel vendors.