



Guidelines and Procedures for the Doctorate of Philosophy

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*This document outlines the Rules and Procedures associated with the progression toward, and earning of, a **Ph.D. in Chemical and Biomolecular Engineering** at Lehigh University. This document is a department-specific supplement to other University and College procedures (e.g., [University Code of Student Conduct](#), P.C. Rossin College of Engineering [Graduate Student Handbook](#)), which outline general expectations of students across all fields of study.*

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Section I: Benchmarks for the Ph.D. Degree

The Department of Chemical and Biomolecular Engineering expects that, under normal circumstances, a graduate student seeking the Doctoral (Ph.D.) Degree will pursue graduate studies and research with vigor so as to satisfy all requirements for the degree within ten semesters (including intervening summers). The following benchmarks provide a means by which satisfactory progress can be measured for completing the program in five years. Note that many of these benchmarks require regular consultation with the student's research advisor.

ALL YEARS

- It is expected that students will spend a *minimum* of 40 hours per week working on the combination of research, teaching assistantship, and classes appropriate for the semester of study. The graduate experience is a full-time obligation. It is expected that graduate students are present in the department at least during regular work hours.
- Students should be aiming towards submitting their work for publication to peer-reviewed archival journals and orally presenting the material at conferences. These are the external benchmarks by which the student's research productivity and quality will be measured. Students must take the initiative and discuss this matter with their advisor, as they are the best judge of timing and quality.
- Students should keep well informed of the current literature pertinent to their research project and field. This requires that students read the most relevant journals. Advisors can guide selection of relevant journals, but students should be taking initiative to stay current with relevant literature.
- Students may expect two weeks of vacation (10 work days) per year excluding national holidays recognized by the University. These times of vacation leave should be arranged through prior consultation with their research advisor in order to avoid detrimental impact on research progress.
- Graduate students are expected to register as full-time students. Students should take courses in Chemical and Biomolecular Engineering and other fields as needed for their research and for enhancing and broadening their background. These courses should be selected in consultation with their advisor and Doctoral Committee.
- Students are required to perform teaching assistant (TA) duties in two to three different semesters during their Ph.D. studies as assigned by the department. TA duties include running recitation section(s), grading homework, and holding office hours. TA's may on occasion be asked to assist with class lectures and proctoring of exams. The time allocated to TA responsibilities can be up to 15 hours per week, but is typically in the range of 5 – 10 hours per week.
- Students must attend Departmental seminars and should register for ChE 455 (Departmental Seminar).

FIRST YEAR

- Complete the Appropriate core courses (see **Section II.1a**).
- Complete the faculty advisor selection procedure (see **Section II.2a**).
- Following the advisor selection, and after consultation with the assigned faculty advisor, begin research activities while completing 1st year courses, during the semester break, and throughout the first summer. *During the first semester break and summer, the majority of student effort should be focused on research activities.*
- Prepare to take the Ph.D. Qualifying Examination (see **Section III**).
- Attend Departmental seminars, even if not registered for ChE 455 due to credit hour limitations.

SECOND YEAR

- Take the Ph.D. Qualifying Examination (see **Section III**).
- Continue research activities throughout the academic year and the summer under the direction of the assigned faculty advisor.
- Consult with faculty advisor regarding course selection to make progress toward completion of the required elective courses (see **Section II.1b**).
- Register as a full-time graduate student each semester (course and/or research credits) until the credit hours required for candidacy have been accumulated (see **Section II.1**).
- Register for and attend Departmental seminars (ChE 455). Exceptions for class conflicts will be reviewed on a case by case basis.

THIRD YEAR

- Complete the “Application for Admission to Candidacy for the Doctorate” *by the end of the 5th semester* (see **Section II.5**; *includes completing Ph.D. Proposal defense*), unless an extension has been approved by the Graduate Committee.
- *Complete the four required elective courses by the end of the 6th semester* (see **Section II.1b**)
- Register for and successfully complete *CHE 496: Safety, Ethics, Communication* in the spring semester.
- Register as a full-time graduate student each semester (course work and/or research) until the credit hours for candidacy have been accumulated (see **Section II.1**) and Proposal Defense has been successfully completed, typically by the end of the 5th semester. Extensions may be granted, but are at the discretion of the Graduate Committee.
- Register for and attend Departmental seminars (ChE 455). Exceptions for class conflicts will be reviewed on a case by case basis.

FOURTH YEAR

- Continue to conduct research under the faculty advisor's guidance.
- After the credit hours for candidacy and proposal defense have been successfully completed, students will register for one credit hour (ChE 455 – Departmental seminar or maintenance of candidacy with ChE 455 being preferred) each subsequent semester.
- Arrange for Doctoral Committee meetings according to the advice of the faculty research advisor (*e.g.*, once every six months). Present research progress and plans for timely completion of the thesis.
- Once the requisite number of credit hours required for graduation are successfully completed, register for one credit hour (ChE 455 – Departmental seminar) each semester following Admission to Candidacy. *Note:* Until all course (see **Section II.1a**) and Ph.D. Proposal requirements have been completed for Admission to Candidacy (see **Section II.5**) the student must register as a full-time graduate student (9 course and/or research credits).
- Register for and attend Departmental seminars (ChE 455). Exceptions for class conflicts will be reviewed on a case by case basis.
- At the end of the fourth year, present to the Doctoral Committee plans for completing all of the requirements for the Ph.D. degree, including a timetable for completion of research and for writing the dissertation during the fifth year.

FIFTH YEAR

- Continue research activity according to proposed plan and in consultation with faculty advisor
- Continue to have meetings with the Doctoral Committee approximately once every six months.
- Attend Departmental seminars, even if not registered for ChE 455.
- Make plans for completing and defending the dissertation by the end of the fifth year (see **Section II.6**).

ADDITIONAL COMMENTS:

The departmental faculty, following the recommendation of the Graduate Affairs Committee (GAC), may establish alternative benchmarks. If it appears to the faculty advisor, to the Doctoral Committee, or to both that the student is not making satisfactory progress and is not expected to complete the Ph.D. within a timely manner, the matter may be referred to the Department Chair or the Chair's designee for resolution. The Department Chair or the Chair's designee shall consider all pertinent facts and shall advise the faculty advisor regarding appropriate actions.

Graduate students should discuss all problems related to their graduate studies with their faculty research advisor. If a problem remains unresolved, then either the student or the faculty advisor should refer the matter to the Department Chair or the Chair's designee.

During the entire period of graduate studies, every student should ensure that the Chemical Engineering Graduate Coordinator in the Chemical Engineering Department office has complete records of the student's progress towards the degree.

Section II: Specific Procedures for the Ph.D. Degree

II.1) Registration Requirements

All Ph.D. students must register for **9 credits per semester** until completion of the following credit requirements *based upon their degrees prior to entering the Lehigh ChBE Ph.D. program*:

- 72 credit hours **beyond a Bachelor's Degree** (see **Table 1**)
- 48 credit hours **beyond a Master's Degree** awarded by another institution (see **Table 2**)

Table 1. Entering program *with Bachelor's degree only*

Registering for 9 credits per semester – Total of 72 credits needed for PhD degree

<u>FIRST SEMESTER (9 credits)</u> CHE 400 Thermodynamics (3) CHE 410 Reaction Engineering (3) CHE 452 Mathematical Methods in Engineering (3)	<u>SECOND SEMESTER (9 credits)</u> CHE 415 Transport Process (3) CHE 496 Grad Professional Development (Safety, Ethics, Communication) (2) CHE 455 Seminar (1) CHE 480 Research (3), or CHE 460 ^(c) Chemical Engineering Project (3) or Elective coursework ^(a) (3)
<u>THIRD SEMESTER (9 credits)</u> Elective coursework ^a (3) CHE 481 Research (3) CHE 460 ^(c) Chemical Engineering Project (2) CHE 455 Seminar (1)	<u>FOURTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (5) Elective coursework ^(a) (3) CHE 455 Seminar (1)
<u>FIFTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (5) Elective coursework ^(a) (3) CHE 455 Seminar (1)	<u>SIXTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (6) CHE 496 Grad Professional Development (Safety, Ethics, Communication) (1) CHE 455 Seminar (1)
<u>SEVENTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (8) CHE 455 Seminar (1)	<u>EIGHTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (8) CHE 455 Seminar (1)

Table 2. Entering program *with Master's degree*

Registering for 9 credits per semester – Total of 48 credits needed for PhD degree

<u>FIRST SEMESTER (9 credits)</u> CHE 400 ^(d) Thermodynamics (3) CHE 410 ^(d) Reaction Engineering (3) CHE 452 ^(d) Mathematical Methods in Engineering (3)	<u>SECOND SEMESTER (9 credits)</u> CHE 415 ^(d) Transport Process (3) CHE 496 Grad Professional Development (Safety, Ethics, Communication) (2) Elective coursework ^(a,e) (3), or CHE 460 ^(c) Chemical Engineering Project (3) CHE 455 Seminar (1)
<u>THIRD SEMESTER (9 credits)</u> Elective coursework ^(a,e) (3) CHE 460 ^(c) Chemical Engineering Project (5) CHE 455 Seminar (1)	<u>FOURTH SEMESTER (9 credits)</u> CHE 499 ^(b) Dissertation (5) Elective coursework ^(a,e) (3) CHE 455 Seminar (1)
<u>FIFTH SEMESTER (9 credits)</u> **CHE 499 ^(b) Dissertation (5) Elective coursework ^(a,e) (3) CHE 455 Seminar (1)	<u>SIXTH SEMESTER (3 credits)</u> CHE 496 Grad Professional Development (Safety, Ethics, Communication) (1) CHE 455 Seminar (1)

^(a) Four graduate electives (300- or 400-level) within or outside CHE must be taken in addition to the core CHE courses. If more (or fewer) electives are taken in a given semester than that which is prescribed, variable credit course registration (e.g., CHE 460, CHE 499) can be adjusted to meet the credit requirements for full-time student status in that semester.

^(b) CHE 499 Dissertation is a variable credit course (1-15 credits) used by students who have passed the qualifying exam.

^(c) CHE 460 is a variable credit course (1-6 credits), and can be taken as needed through the third semester

^(d) A student can petition to waive up to two core courses based upon their prior Chemical Engineering Master's degree. Graduate electives (300- or 400-level) within or outside CHE **or** variable credit courses (e.g., CHE 460, CHE

499) can be used to meet the credit requirements for full-time student status in a semester when one or more core courses have been waived as well as to meet the overall requirement of 48 credits.

(e) If a student with a prior Master's degree successfully petitions to waive 1 to 2 (max) elective courses, they are only required to take, respectively 3 or 2 elective graduate courses at Lehigh.

Pre-candidacy registration: All students must maintain full time status by registering for 9 credit hours (maximum 10 credit hours) per semester. Students who complete the tuition registration requirements before being formally admitted to candidacy (see **Section II.5** below regarding Candidacy) must continue to register for three credits per semester and be "certified" as a full-time student on the registration form.

Candidacy registration: Once the registration requirements are met and admission to candidacy has been awarded, registration for 1 credit (ChE 455) in each academic semester until 6 months prior to graduation is required.

International students must complete a full-time certification petition prior to the start of each semester in which they register for less than 9 credits.

II.1a) Required Core Courses

All full-time students must complete five required core courses during their initial year of residency with the exception of students with spring admission, who must complete these core courses within their first three semesters of residency (see course listing below). First year students must receive a GPA of at least a 3.15 in the required core courses to remain in good standing and be eligible to take the Ph.D. Qualifying Examination (see section II.4 below). In addition, all full-time students are expected to complete ChE 496 (the 1 credit option) in the Spring semester of their 3rd year.

- ChE 400 (3 credits) – Chemical Engineering Thermodynamics (Fall term)
- ChE 410 (3 credits) – Chemical Reaction Engineering (Fall term)
- ChE 452 (3 credits) – Mathematical Methods in Chemical Engineering (Fall term)
- ChE 415 (3 credits) – Transport Processes (Spring term)
- ChE 496 (2 credits) – Grad Professional Development (Safety, Ethics, Communication) (Spring term)

II.1b) Other Courses

Elective courses: It is required that each student take an **additional four graduate courses** in one or more fields. These must be scheduled in consultation with the faculty advisor.

Departmental seminars (ChE 455): All full-time Ph.D. students are expected to register for and attend all departmental seminars. Graduate students should register for Departmental Seminar each semester (1 credit per semester), except as noted above re. Candidacy registration.

Additional courses: (taken in consultation with the Chemical Engineering Graduate Coordinator)

- ChE 480 and 481 (3 credits each): Research (Courses for Master's-level research only. Any student who does not already hold a Master's degree from Lehigh or another institution may register for each course only once during their graduate studies. Students may register for both courses in the same semester).
- ChE 496: Grad Professional Development (Safety, Ethics, Communication) is a **required** course for **all 1st and 3rd year** ChBE Ph.D. students. Any student receiving a grade lower than 'B' in ChE 496 **will be prohibited from performing research** toward their degree completion until they successfully retake the course.
- ChE 499: Dissertation (used by students who have passed the qualifying exam).

II.1c) Concentrated Learning Requirement (applies to part-time Ph.D. students only)

Either two semesters of full-time graduate study or 18 credits of Lehigh graduate study within a fifteen-month period (either on or off campus) must be completed.

II.1d) Waiver of Core and Elective Courses for Students Entering with an MS/ME

Petitions to waive a subset of the core and elective course requirements submitted by Ph.D. students entering with an MS/ME degree will be considered by the Graduate Affairs Committee per the policies

outlined below. Granting of waiver requests does not amount to a transfer of credits, but is instead simply a waiver of the specific course requirement. Credit requirements (**Section II.1**) must be alternatively fulfilled through research, dissertation, and/or departmental seminar credits. ChE 496 is not eligible for waiver.

Core Course Waivers:

Students entering Lehigh's ChBE Ph.D. program with an MS/ME degree in Chemical Engineering from another institution may be eligible to have up to two of the four core courses waived upon entry into the PhD program. The Graduate Committee will make an effort to proactively evaluate student transcripts, however it is recommended that students who are interested in a course waiver also consider submitting a petition. Students entering Lehigh's ChBE Ph.D. program with an MS/ME degree in another discipline may petition to have no more than two of the four core courses on the basis of graduate level courses completed during their MS/ME degrees waived. In order for course waiver requests to be considered, they must be submitted to the Graduate Program Coordinator (via incheqs@lehigh.edu) by no later than 2 weeks ahead of the first day of the semester along with, at a minimum, the detailed course syllabus and official documentation of the grade received in the course. Requests may be made for additional material to help in the evaluation of the request; such material may include sample exams, HW assignments, etc.

Decisions on Core Course Waiver Requests: The waiver and course material provided by the student will be reviewed by the Graduate Committee, with input from the past 1-3 instructors of the course on an as needed basis. Decisions regarding the waiver request will be made based, at least in part, upon the student having earned a grade of at least an A- in the course and an assessment of the extent of overlap with the material covered in the equivalent Lehigh course.

Elective Course Waivers:

Students entering Lehigh's ChBE Ph.D. program with an MS/ME degree from another institution may seek to waive no more than two of the four required elective courses on the basis of graduate level courses completed during their MS/ME degrees. In order for course waiver requests to be considered, they must be submitted to the Graduate Program Coordinator (via incheqs@lehigh.edu) and discussed with the student's research advisor, and should include, at a minimum, the detailed course syllabus and official documentation of the grade received in the course. Requests may be made for additional material to help in the evaluation of the request; such material may include sample exams, HW assignments, etc. Waiver requests made after a student has completed their first 2 years in the program will not be considered.

Decisions on Elective Course Waiver Requests: The waiver and course material provided by the student will be reviewed by the student's research advisor who will make a recommendation to the Graduate Affairs Committee regarding the number of elective courses to be waived. The Graduate Affairs Committee will be responsible for granting final waivers. Decisions regarding elective waiver requests will be made based, at least in part, upon the student having earned a grade of at least a B.

II.2) Assignment of Faculty Advisor

During the first semester of residency the Chair of the Graduate Affairs Committee serves as the faculty advisor. Research presentations will be made by faculty in the early-to-mid fall semester to highlight available research opportunities. Ph.D. students are *required to attend all presentations*, and *must schedule appointments to discuss available research projects with at least 5 individual faculty members*. *Individual meetings with faculty advisors are a critical part of the process*, allowing for better understanding of the research opportunity and for informed decisions by both students and faculty in the final student-advisor matching process. Before the end of the first semester of residency (by date specified by the Chair of the Graduate Affairs Committee, typically end of September), each student must complete the advisor selection process, whereby they submit a rank ordered list of at least 4 research groups they would like to join. Based on student preferences, individual faculty feedback and available funding, students will be assigned a faculty advisor by the Advisor Selection Subcommittee of the Graduate Affairs Committee. The Advisor Selection Subcommittee will make every effort to match students with their top choice in research group, but in some instances several students may select the same project and a first choice cannot be assigned to all of them. In those cases, the Chair of the Graduate Affairs Committee will work with each student and with faculty to identify a good

advisor match for each student. Typically, the faculty advisor selection process will be complete by early November

Requests to change faculty advisors/research groups following the initial assignment are strongly discouraged given the disruption they impose on progress in the program. Such requests, when necessary, must be made formally in writing and submitted for consideration to the Graduate Affairs Committee via incheqs@lehigh.edu. In the case that such a petition is granted, identification of other funded research opportunities must be coordinated directly through the Graduate Affairs Committee rather than through personal contact initiated by the student with individual faculty.

II.3) Research Activity and Progress

After assignment of the permanent faculty advisor, students must become involved in research. Significant research progress, as directed by the dissertation advisor, is expected of all graduate students. *Progress in research is a critical component of the Ph.D. Qualifying Examination.* To be eligible to engage in research following the Spring semester of their 1st year, PhD students must successfully complete ChE 496, receiving a grade of 'B' or higher.

II.4) Ph.D. Qualifying Exam

All full-time students who have earned a GPA of at least a 3.15 in the required core courses are eligible to take the Ph.D. Qualifying Examination. The purpose and details of this exam are provided separately in **Section III**.

II.5) Procedure for Admission to Ph.D. Candidacy

Summarized below are key elements for Admission to Candidacy. Formal detailed instructions are available from the Chemical Engineering Graduate Coordinator.

- a) Pass the ChE Ph.D. Qualifying Examination (see **Section III**).
- b) Conduct research and write the Ph.D. Proposal in consultation with the faculty advisor (see **Section IV**). *The Proposal defense should be completed by the end of the 5th semester*, unless an extension has been approved by the Graduate Committee
- c) Constitute the Ph.D. Doctoral Committee in consultation with the faculty advisor to include a minimum of four members. At least three members should be faculty from the Department of Chemical and Biomolecular Engineering including the research advisor(s). At least one additional member of the committee must be from outside the Department of Chemical and Biomolecular Engineering. In the event that the dissertation research is co-advised by 2 or more faculty, the Ph.D. Doctoral Committee should comprise all co-advisors plus 3 independent committee members.
- d) Schedule a formal oral presentation for the first Doctoral Committee Meeting.
- e) Distribute a copy of the Ph.D. Proposal to each member of the Doctoral Committee at least two weeks prior to the meeting.
- f) Defend the Ph.D. Proposal before the Doctoral Committee (see **Section IV**).
- g) Upon passing the Proposal Defense, complete and obtain signatures from all Doctoral Committee members on the appropriate document, and return the signed form to the Graduate Coordinator. Forms can be found at: <https://engineering.lehigh.edu/academics/graduate/student-resources>
- h) At least 12 months before the Ph.D. degree is expected, formally apply for candidacy using the form entitled "Application for Admission to Candidacy for the Doctorate." This form is available electronically from the Chemical Engineering Graduate Coordinator. Submit a completed copy to the Dean's Office in the College of Engineering and Applied Science as soon as it is approved by the Committee. Additional rules are included on the form.

II.6) Post-Ph.D. Candidacy Procedure

- a) Work toward goals outlined by student's approved proposal in consultation with faculty advisor.
- b) Consult the University calendar for graduation dates and deadlines. Work backwards from the specified dates, and set the fourth (and fifth) year schedule to meet these deadlines by consulting with the faculty advisor.

- c) Prepare the thesis outline, get the approval of the advisor, and begin writing the various sections of the dissertation as early as possible.
- d) Upon completing the first draft of the dissertation or some of its chapters, submit it to the faculty advisor and seek his/her comments by an agreed-upon date.
- e) Make needed corrections until the faculty advisor is satisfied that the dissertation is suitable for distribution to the members of the Doctoral Committee and the Dean's Office in the College of Engineering and Applied Science.
- f) Submit a rough draft, signed by the faculty advisor and one committee member, to the Dean's Office in the College of Engineering by the deadline specified on the University's Academic Calendar (at least six weeks prior to graduation). Distribute copies of the full dissertation draft to the Doctoral Committee for review and revisions. The dissertation should be provided to the Doctoral Committee *at least two weeks in advance of the Dissertation defense*.
- g) Schedule a Dissertation Defense before the Doctoral Committee and other interested parties. Notify the Dean's Office in the College of Engineering and the Chemical Engineering Graduate Coordinator in advance of the date. Secure a "Report on the Doctoral Dissertation Exam" form from the Chemical Engineering Graduate Coordinator. It must be signed by the Doctoral Committee at the defense. Submit the original to the Dean's Office in the College of Engineering and a copy to the Chemical Engineering Graduate Coordinator.
- h) Successfully defend the dissertation. Have the Committee members sign the "Report on Doctoral Dissertation Examination". Submit a copy to the Chemical Engineering Graduate Coordinator, and file the original with the Dean's Office in the College of Engineering and Applied Science.
- i) Collect all comments and proposed changes from the members of the Committee following the defense.
- j) Make the required changes and final corrections to the dissertation, and get final approval from the Committee members. This is accomplished by having them sign a signature page stating that the dissertation has been approved. This page is then included in the dissertation.
- k) Submit the original documents to the Dean's Office in the College of Engineering and Applied Science. The student must pay any required fees and present a Bursar's receipt as proof of payment. The student's advisor should get a hard bound copy of the Dissertation. The student must submit a pdf version of the Dissertation to the Chemical Engineering Graduate Coordinator.
- l) Submit an online "Application for Degree" form to the Registrar's Office before the deadline date in the catalog. There is a late fee if the deadline is missed. Also, if the expected graduation date is missed after filing this form, the student must reapply in the semester he/she will graduate. Therefore, promptly notify the Chemical Engineering Graduate Coordinator, the Dean's office, and the Registrar of any changes in the graduation date.
- m) Submit an "Interdepartmental Clearance Sheet" (available from the Chemical Engineering Graduate Coordinator) to the Registrar *at least three days prior to graduation*. It must be signed by the advisor, the Department Chair (or designee), and Facilities before the student is allowed to receive the degree. In addition, the student must clear any outstanding debts with the Bursar prior to graduation.

Section III: Ph.D. Qualifying Examination

III.1) Purpose and Background

The purpose of the PhD Qualifying Examination, which is comprised of a formal written *Research Report* and an *Oral Presentation and Examination*, is to provide a departmental judgment on whether a graduate student has the potential to satisfactorily complete the PhD program. The ChBE Qualifying Examination satisfies the RCEAS requirement that graduate students pass a general examination. Consequently, this is one of the most critical examinations for the degree. All full time and part time graduate students seeking the PhD degree are required to take the PhD Qualifying Examination at the beginning of the third semester of residency. Exceptions to this schedule need to be approved by the Chemical Engineering Graduate Affairs Committee through a petition. The minimum requirement to take the qualifying exam is to earn a GPA of 3.15 or higher in the required core technical courses (ChE 400, ChE 410, ChE 415, ChE 452) taken at Lehigh University. Students with a GPA below 3.15 in the core courses must submit a petition to the Chemical Engineering Graduate Affairs Committee to request an exception to this grade point requirement. It should be noted, however, that petition approval requires identification of extenuating circumstances or clear indications of exceptional factors related to the coursework and research.

Once the GPA requirement has been met, evaluation of the student at the time of the qualifying exam will be based on the following criteria:

- a) **Progress in independent research:** Through his or her work under the supervision of the faculty advisor, the graduate student must demonstrate his or her ability to learn independently about the assigned research topic, to produce results, and to start formulating the direction of his or her research project.
- b) **Demonstration of independent critical thinking and understanding of research in the Written Report and Oral Examination:** Both the written and oral components will be assessed for the students' comprehensive understanding, critical and independent thinking, and demonstrated progress toward initial research goals. Specific elements that will be evaluated include students' ability **1)** to clearly convey fundamental conceptual understanding of the physical problem being studied and its broader implications, **2)** to identify, distill, and critically evaluate relevant research from the open literature, **3)** to explain the related current state-of-the-art in their field and how it frames the specific research they are carrying out, **4)** to clearly present the results of independent research he/she has carried out as warranted by the specific line of research, and **5)** to provide critical analysis of those results framed by perceived short and long-term goals of the work.

A graduate student meeting the minimum GPA requirement is allowed two attempts to pass the PhD Qualifying Examination. A graduate student who has received approval of his/her petition for waiver of the minimum GPA requirement is allowed only one attempt at passing this exam.

III.2) Detailed Procedures

- a) Students are assigned to research groups in late fall of their first year, and are expected to immediately start their research in consultation with their faculty advisor(s). Students will carry out research during the semester break, spring semester, and summer months of their first year in the program in the lead-up to the Ph.D. Qualifying Examination.
- b) Upon completion of the core courses with a cumulative GPA of 3.15 or higher (normally by the beginning of the third semester in residence), the Graduate Affairs Committee will provide written confirmation regarding the student's eligibility to take the qualifying examination. If the student does not meet the minimum GPA criterion of 3.15 in the core technical courses, the student may petition the Graduate Affairs Committee to proceed with the PhD Qualifying Exam. If the committee approves such a petition, the student is allowed only one attempt to pass the Qualifying Examination.
- c) The student will be required to prepare and submit a formal written *Research Report* on his/her research and to prepare and deliver an *Oral Presentation and Examination* on the same before the faculty. These should both convey a comprehensive understanding of the research problem, the purpose and motivation for the research in the context of the greater literature and state-of-the-art

in the field, an understanding of critical fundamental concepts underpinning the research, a carefully organized and distilled technical summary of research findings to date, and a critical analysis of those results framed by perceived short and long-term goals of the work. Importantly, the emphasis of the written and oral exams is on a balance between comprehensive understanding, critical and independent thinking, and demonstrated progress toward initial research goals. While close collaboration and consultation with one's research advisor(s) is critical as research progresses during the first year of PhD studies, **preparation (e.g., report writing, slide preparation, presentation practice) for the Ph.D. qualifying examination must be carried out without specific input from the faculty advisor(s). Advisors are strictly prohibited from giving feedback to students on either the oral or written component of the qualifier preparation.**

- d) On a date specified by the Graduate Affairs Committee up to one week in advance of the scheduled date for the oral portion of the Qualifying Examination, students must submit their written Research Report.
- e) On the day of the Oral Examination, the student must give a PowerPoint (or equivalent) presentation in front of the Chemical and Biomolecular Engineering Faculty that covers the topics described above and any additional factors detailed for all students in advance of the exam. The specific oral presentation by the student may not exceed 15 minutes. An additional 20-25 minutes will be reserved for oral examination by the faculty aimed at probing the students' understanding of her/his research, related literature, and fundamental chemical engineering underpinnings of the research as well as her/his independent and critical thinking skills.
- f) The faculty will consider a student's performance on both the written and oral portions of the qualifying examination as the basis for deciding on passage or failure of the exam. The Chair of the Graduate Affairs Committee will promptly notify the student of the faculty decision in writing after the faculty's determination and Department Chair's approval.
- g) Students who pass the qualifying examination will continue their research progress toward subsequent milestones in the PhD program, with strong encouragement for students to form their Ph.D. committees shortly after passage of the qualifier.
- h) Students who fail the qualifying exam on their first attempt who met the minimum GPA requirement to take the exam will be given one opportunity to retake the qualifying exam. The second attempt should be completed within 3 months of the first attempt or at the time specified by the Department. Students who pass the second attempt at the qualifier should follow procedures specified above. Terminal failure of the qualifier deems a student ineligible of pursuing a Ph.D. and has funding implications (see "Policy on following Terminal Failure of Ph.D. Qualifying Exam" in **Section IV**), but pursuit of an MS/ME degree may still be possible.

Section IV: Thesis Proposal and Oral Defense

The thesis proposal must be presented in writing to the Doctoral Committee (see Section II.5 above) and must include the following:

- objectives and specific aims of the research
- thorough but concise review of the relevant literature
- significance of the proposed work and its scientific and societal impact
- preliminary work
- outline of the proposed methodology, anticipated difficulties, and methods for overcoming these difficulties
- timetable for completion of the thesis

The proposal should be between 15 and 20 pages in length (single spaced, 12 point Times New Roman font or equivalent, 1 inch margins, including Figures and Tables). A one page abstract is also required, as well as appropriate references (not subject to the page limit). The proposal must be defended orally before the Doctoral Committee, whose members must receive the written proposal no later than two weeks prior to the oral examination. The student must also circulate to faculty and graduate students (via the Graduate Coordinator) an announcement of the time and place of the thesis proposal defense.

This must be done at least two weeks prior the date of the defense. The defense will consist of an oral presentation (20 - 30 min) by the student, followed by a question and answer session. The length of written report or proposal presentation may deviate from these guidelines at the discretion of the PhD advisor.

The subject matter of the oral defense will be based on, but is not limited to, the research proposal. The Doctoral Committee will be constituted as defined in section II.5 above. In the case where a student has at least three co-advisors, a sixth committee member is required, and at least one of the non-advisor committee members must be a member of the Department of Chemical & Biomolecular Engineering faculty. Given the additional scheduling constraints imposed by having a sixth committee member, the expectation that all committee members must participate in the thesis proposal defense is relaxed such that only five committee members must participate; of those five, at least three should be non-advisor committee members, even if this precludes all advisors from participating. A brief resume must be included for any member who is not a Lehigh University faculty member. The Graduate Committee must approve the Doctoral Committee at least 30 days prior to the proposal defense date. The thesis proposal defense should be completed by the end of the fifth academic semester at Lehigh, unless an extension has been approved by the Graduate Committee.

Section V: Conduct and Standing in the ChBE Ph.D. Program

V.1) Maintaining Good Standing in the Ph.D. Program

Full-time funded research assistantships within the department are contingent upon satisfactory progress toward academic and research goals and program milestones. Academically, no grade below “C-” may be counted toward a graduate degree. No regularly admitted student who receives more than four final course marks below a B- in courses numbered 200 or higher is allowed to continue registration as a graduate student. The relevant research policy, established by the department faculty and by the University Graduate and Research Committee, notes that progress requires sustained commitment by the Ph.D. student to his/her research as demonstrated by active participation in the associated work as well as progress toward project goals and milestones established by his/her advisor and the associated funding agencies and reviewed by Lehigh’s Office of Research and Sponsored Programs.

V.2) Policy on Funding following Terminal Failure of Ph.D. Qualifying Exam

Funding is no longer guaranteed for students who lose eligibility to pursue a Ph.D. upon terminal failure of the first or second (re-take) attempt at the Ph.D. qualifying exam.

V.3) Ethical Conduct in Coursework and Research

It is the student’s responsibility to respect Lehigh University’s policies on plagiarism and academic integrity. Evidence of plagiarism, cheating, or unethical conduct in any form can be referred to the University Committee on Discipline. Lehigh’s ChBE program holds its Ph.D. students to the highest ethical standards. Therefore, any formal University disciplinary action will result in placement of the student on probation and, depending on the degree of misconduct and formal disciplinary finding, can result in dismissal from the ChBE Ph.D. Program.

V.4) Medical Leave of Absence

In the case of unforeseen medical issues arising in the course of a Ph.D., University policies do allow students to make a formal request for a Leave of Absence. Such requests must be made in writing and submitted to the Graduate Affairs Committee for review. If granted, University Policy enables return at a later date for resumption of studies. Per the [College of Engineering Graduate Student Handbook](#), students funded through research grants must consult with their faculty advisor about funding limitations, recognizing that the funding may not be available if/when the student returns.

V.5) Formal Requests for Deviations from Program Policies and Procedures

Any deviation from the Program policies and procedures outlined in this document requires **formal written request/petitions** to be submitted to the Graduate Affairs Committee for review and feedback. Petitions should describe the request and provide corresponding detailed justification. Petitions should be submitted to the Graduate Affairs Committee by e-mail to incheqs@lehigh.edu. Receipt of the petition will be acknowledged by e-mail and an approximate timetable for formal response will be provided. Once the petition has been reviewed by the Committee, a formal response will be sent to the student.

Section VI: Miscellaneous Employment Information

Employment Certification

All RA's, TA's, GA's and Fellows receiving stipends from Lehigh University must complete an I-9 Form and other Payroll documents. These documents must be submitted to the Chemical Engineering Graduate Coordinator with any combination of the documents listed on the I-9 form.

Taxes

Students are responsible for paying all taxes associated with their compensation. Student status may change from term to term from TA, RA, GA, Fellowship, and other forms of support, and each will have different rules regarding applicable Federal, State, and Local taxes. Tuition paid by the Department or another source may be subject to tax although taxes are not explicitly withheld for this mode of compensation. Students may qualify for various postsecondary tax credits and deductions, so they are required to read and comply with all tax regulations associated with related compensation. International students are advised to consult the Office of International Students and Scholars regarding applicable taxes.

The City of Bethlehem levies an Emergency Municipality Service Tax once a year on all positions except Fellows. TA's, GA's, and RA's do not pay FICA taxes in the Fall and Spring semesters. Anyone working full-time (30 hrs. or more) during the summer will be charged FICA.

Health Insurance

All graduate students are required to carry sufficient health insurance. Lehigh University offers a health insurance plan for graduate students, and for full-time students on a graduate assistantship or graduate fellowship, the University offers a subsidy of 70 % to help defray the cost.