JOHNS HOPKINS
UNIVERSITY
Chemical and Biomolecular Engineering

Masters of Science in Engineering (MSE)
Student Handbook
2024 – 2025

(Updated July 2024)

A Welcome from The Director of Masters' Studies

Hello! Welcome to the Johns Hopkins University Department of Chemical and Biomolecular Engineering! We're excited that you've chosen to join us for your Masters' studies, and we're eager to help get you to where you want to be once you complete our program. Our graduates go on to pursue careers in industry or further their education through PhD or even MD programs. Our mission is to prepare you for these positions and programs.

Regardless of where you are coming from, whether your undergrad studies were at a big school or a small one, whether you studied chemical engineering previously or not, whether you are an international or domestic student, whether you are the first in your family to come to graduate school or come from a long line of Nobel Laureates, we want everyone to have a strong start and a strong finish here. Please do not hesitate to ask any questions! We much prefer to be asked too much than asked too little! I also recognize that some parts of pursuing a MSE can be stressful, and we again encourage you to ask for help than to tough it out on your own. All of us have gotten to where we are through the kindness of others, and we are ready to spend time with you to make sure you are supported every step of the way until graduation!

If you would like to meet with me (virtually or in-person), please send me an email. We look forward to getting to know you!

Sincerely,

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Master of Science in Engineering (MSE) Degree Program Overview

The MSE in Chemical and Biomolecular Engineering at Johns Hopkins is a flexible, dynamic program, with several options to accommodate students' varied interests and career aspirations.

The Essay-Based MSE:

The most popular option, this is a research-intensive MSE program. Students take 18 credits of graduate-level coursework (typically 6 classes) and also undertake original research, totaling at least 12 required Research Credit hours (EN.540.801). This program culminates in a final presentation, open to the department, and essay, which must be submitted to the Sheridan Library's Electronic Thesis and Dissertation database (ETD). The essay-based option typically requires four semesters to complete; it may take fewer semesters to complete for students who began their research project while an undergraduate at Hopkins. Students may also need to complete their research, presentation, and essay, in the second summer of their program.

The Coursework-Based MSE:

The department also offers coursework-only degree in which students take ten 3-credit graduate courses. This option typically takes three semesters to complete, but may require fewer semesters for students who began graduate coursework while an undergraduate at Hopkins (see "Combined BS/MSE Program and Students with BS in ChemBE from Johns Hopkins" below for more details).

The Master of Science in Engineering Management (MSEM):

This program is administered through the Center for Leadership Education (CLE), combining courses in ChemBE with those in management. See https://msem.engineering.jhu.edu/ for more.

MSE Student Advising and Selection of Courses

- Before beginning their first term in the MSE program, students should **submit their undergraduate transcript** to the Director of Masters' Studies; an unofficial copy is sufficient.
- Essay-based MSE students will be assigned an advisor within the first semester (see details below about the Research Advisor Selection Process); coursework-only students will be advised by the Director of Masters' Studies throughout their degree program.
- Before registration begins for any semester, the student and their advisor will select courses together to design a curriculum appropriate for the student's research interests and educational needs and goals. Students should consult their advisor when registering for every term. Together, the student and advisor should update the student's MSE checklist each term to ensure that degree/program requirements will be met.
- Course substitutions, exceptions, and waivers must be approved by the Director of Masters' Studies; documentation of these approvals should be shared with the MSE Academic Program Administrator for inclusion in graduation materials.
- After a student registers for their final semester, they should send their MSE checklist to their Faculty Advisor for approval and final signature; the final signed MSE checklist is included in graduation materials.

Research Advisor Selection Process for Essay-based MSE

Most students who plan to pursue the essay-based MSE are initially assigned to the Director of Masters' Studies as an advisee; the Director will assist students with their first fall semester registration and advising during summer. During the student's meeting with the director for advisement, they may indicate their aim of completing the essay-based MSE.

A matching process takes place beginning in summer and continuing through the fall semester. A list of potential research projects in labs for MSE students is published in the summer session and updated regularly throughout fall to indicate filled positions and add new projects. It is the student's responsibility to arrange at least three meetings with faculty members whose projects or lab openings are of interest. Once faculty permission to do so is obtained, students should attend the lab meeting of the PI's group. After attending each of the three or more meetings, students must complete the required form to indicate which lab meeting was attended and provide a brief summary.

When a student and faculty member mutually agree to work together on a project, the faculty member should e-mail or otherwise inform the MSE Academic Program Administrator so that the student may be assigned as their official advisee in SIS.

Should a student interested in a lab placement be unable to arrange one by the end of their first semester, the Director of Masters' Studies will work with that student to arrange a placement where possible. Students without a research advisor at the start of their second semester (typically Spring) will be enrolled in the course-based MSE OR may seek an internship or co-op position that will allow them to continue in the essay-based program.

MSE students can do their research with any primary ChemBE faculty or with faculty with secondary appointments in ChemBE. If a student wants to pursue a project with a faculty member who is not affiliated with the department, the student must find a primary ChemBE faculty member to sponsor the project and serve as their second reader for their essay. Students who complete research as part of an internship or co-op must also find a primary ChemBE faculty member to supervise their research and essay and serve as first reader for their essay, while their supervisor in the internship or co-op will serve as second reader. Students in non-ChemBE faculty labs and on co-op/internship should meet regularly with their primary ChemBE advisor (at least twice per semester) to make sure they are on track to graduate. It is the student's responsibility to provide regular updates and initiate scheduling of meetings or email communications.

Residency Requirement

Students pursuing an MSE degree are subject to the WSE residency requirement (https://engineering.jhu.edu/education/graduate-studies/graduate-academic-policies-procedures/). Every student must register as a full-time graduate student for **at least two semesters** or satisfy an equivalent requirement approved by the appropriate department. Concurrent BS/MSE students are exempt, as are students beginning their MSE degree within two semesters of having completed a JHU undergraduate program.

Course Requirements

The following program requirements and policies apply to all ChemBE MSE students, with exceptions noted.

- Full-time registration for MSE students is 9 credits per semester. For more information about Johns Hopkins University's policy on credit hours, please visit https://homewoodgrad.jhu.edu/academics/wse-graduate-credit-hours/.
    - Note that students on the essay-based program must still register for 9 credits per semester, even though they may have finished their coursework. Research credit is typically used to make up the difference and reach 9 credits. Research done towards the MSE degree is a graduation requirement, and therefore full-time status cannot be waived. Essay-based students in a campus lab should register for at least 12 credits of EN.540.801 with their advisor during their program; essay-based students completing a co-op or internship can apply for non-resident status and earn 9 credits of research through the NR coursework designation per semester.
- The majority of courses taken for the MSE should be 3+ credit courses.
- Students must take and successfully pass the required minimum of graduate-level coursework (i.e. 600-level and above), depending on their chosen program (essay or coursework):
    - 18 coursework credits plus 12 research credits (EN.540.801) for essay-based students (total of 30 credits)
    - 30 coursework credits for coursework-based students
- At least 12 of the required 18 coursework credits for essay-based and design-based students, or at least 18 of the required 30 credits for course-based students, must be from courses in the Chemical and Biomolecular Engineering Department (EN.540.6xx or EN.545.6xx). 9 of these credits are in the MSE core courses (see below). Exceptions to this rule are rare made and must be approved by the Director of Masters' Studies. A course from a department other than ChemBE may count towards these credits **only** if the course
    - has significant ChemBE content
    - is 3 or more credits, and
    - is consistent with the student's research interests and educational goals as determined by the student's research advisor and the Director of Masters' Studies.
- Students may not count undergraduate courses (400-level courses or lower) towards their MSE degree unless
    - the course is not offered at the 600 level
      AND
    - the department offering the course considers it a graduate-level course in their program. In such cases, a letter from that department's head, chair, or graduate program director should be included in the submission of graduation materials.
- Courses offered at both the 400 and 600 levels **must** be taken at the 600 level to be counted as MSE course requirements. All ChemBE coursework must be taken at the 600 level.
- ChemBE courses should be **approved by the student's research advisor; non-ChemBE courses should be approved by the student's research advisor AND the Director of Masters' Studies prior to registration each semester**.

- To count towards the degree, courses must be taken for a letter grade; such courses **cannot include non-ChemBE seminars, independent studies, graduate research, or special studies.**

Courses Required of All ChemBE MSE Students

- All students must complete a mandatory Academic Ethics module their first semester and earn a passing grade. The course EN.500.603 will be automatically added to your SIS enrollments and should not be dropped. See Graduate Student Orientation - Johns Hopkins Whiting School of Engineering (jhu.edu) for more information.
- All students must enroll in *at least one* semester of Chemical and Biomolecular Engineering Seminar (EN.540.600 in Fall or EN.540.601 in Spring) and earn a passing grade. It is highly recommended that this requirement be fulfilled during the student's first semester, usually fall.
- Students must enroll in EN.500.601 Lab Safety in their first spring semester.[1]
- All students must complete Responsible Conduct of Research training, **either** by completing the required modules, which can appear on transcripts as AS.360.624, **or** by taking AS.360.625.

Core Courses

All students must take **three** core courses, **one from each** of the following categories:

- **Core 1: Thermodynamics**
  - EN.540.671 Advanced Thermodynamics in Practice, typically offered in Spring.
  - With approval from the Director of Masters' Studies and the instructor, the more advanced EN.540.630 Thermodynamics & Statistical Mechanics may be substituted; 630 is typically offered in Fall.

- **Core 2: Transport**
  - EN.540.604 Transport Phenomena in Practice, typically offered in Spring.
  - With approval from the Director of Masters' Studies and the instructor, EN.540.652 Advanced Transport Phenomena may be substituted; it is typically offered in the Fall.

- **Core 3: Kinetics**

After consulting with their primary advisors to determine which Core 3 course best suits their focus area (see below) and/or research interests, students may choose any one of the following courses:

- EN.540.602 Metabolic Systems Biotechnology (fall)
- EN.540.632 Project in Design: Pharmacokinetics
- EN.540.633 Pharmacokinetics and Pharmacodynamics (fall)
- EN.540.638 Advanced Topics in Pharmacokinetics and Pharmacodynamics I (fall)
- EN.540.673 Advanced Chemical Reaction Engineering in Practice (spring)
- EN.540.681 Molecular Kinetics and Catalysis (spring)

[1] Students who attended JHU for their undergrad program are exempt from this requirement if they took EN.540.490 - Introduction to Chemical Process Safety.

MSE Program Focus Areas

MSE students in ChemBE may opt to focus their studies within an area of specialization. The program offers three focus areas as of Fall 2024:

1. Cellular, Molecular, and Biopharmaceutical Engineering
2. Chemical and Sustainability Engineering
3. Molecular Modeling, Data Science, and AI

Students completing the essay-based MSE should consult with their advisors to determine which **two or more focus area courses** best suit their research and interests. Students in the coursework-based MSE consult their advisor to determine which **four or more focus area courses** best suit their professional interests.

Note that students may also work with their advisors to select an appropriate Kinetics (Core 3) course to enhance their focus area (for example, students in the Cellular, Molecular, and Biopharmaceutical Engineering focus area may choose to take EN.540.602 Metabolic Systems Biotechnology to fulfill their Core 3/Kinetics requirement, and also take two additional courses from the list of focus area courses below).

Students may choose to continue to take courses from the focus area for their additional electives or choose other graduate level courses. Note that the majority of every student's graduate-level MSE coursework should be in ChemBE, regardless of focus area (see p. 3).

Focus Area 1: CELLULAR, MOLECULAR, AND BIOPHARMACEUTICAL ENGINEERING

Course options:

- EN.540.602 Metabolic Systems Bioengineering
- EN.540.633 Pharmacokinetics and Pharmacodynamics
- EN.540.638 Advanced Topics in Pharmacokinetics and Pharmacodynamics I
- EN.540.640 Micro/Nanotechnology: The Science and Engineering of Small Structures
- EN.540.665 Engineering Principles of Drug Delivery
- AS.030.623 Molecular Synthetic Biology
- EN.540.614 Computational Protein Structure Prediction & Design
- EN.540.618 Cancer Metabolism
- EN.540.626 Fundamentals of Cell Bioengineering
- EN.540.628 Supramolecular Materials and Nanomedicine
- EN.540.637 Application of Molecular Evolution to Biotechnology
- EN.540.667 Targeted Drug Delivery: Mechanistic Concepts
- EN.580.646 Molecular Immunoengineering

Focus Area 2: CHEMICAL AND SUSTAINABILITY ENGINEERING

Course options:

- EN.540.607 Renewable Energy Technologies
- EN.540.673 Advanced Chemical Reaction Engineering in Practice
- EN.540.602 Metabolic Systems Biotechnology
- EN.540.615 Interfacial Science with Applications to Nanoscale Systems
- EN.540.640 Micro/Nanotechnology: The Science and Engineering of Small Structures

- EN.540.681 Molecular Kinetics and Catalysis
- EN.540.658 Modeling and Design of Sustainable Chemical Processes
- EN.510.625 Advanced Materials for Battery
- AS.030.604 Electrochemical Systems for Energy Conversation and Storage
- EN.510.658 Electroanalytical Chemistry and Energy Conversation

Focus Area 3: MOLECULAR MODELING, DATA SCIENCE, AND AI

Course options:
- EN.540.605 Modern Data Analysis & Machine Learning for ChemBEs
- EN.540.614 Computational Protein Structure Prediction & Design
- EN.540.658 Modeling and Design of Sustainable Chemical Processes
- EN.540.635 Software Carpentry

Course Substitutions

Substitutions for core courses may be granted for students with ChemBE backgrounds. However,

- Only one course, EITHER for Core 1 OR for Core 2, may be a substitution. (Students in the BS/MSE program may substitute for both Core 1 and Core 2.)
- Students cannot take both versions of the Core 1 or 2 courses and count both towards their course requirements. For example, students cannot count both EN.540.604 and EN.540.652 towards their requirements.
- Multiple courses in Core 3 can be taken for course requirements and will count as electives.

Preparatory Courses for Students without Degrees in ChemBE

Students will need to demonstrate proficiency in the core Chemical Engineering subjects of Thermodynamics, Transport, and Kinetics to fulfill their MSE degree requirements. This proficiency is typically met through taking the three required MSE core courses. In special circumstances, and with pre-approval from the Director of Masters' Studies, other equivalent courses can be used to substitute for the proficiency requirements.

Incoming MSE students arrive with diverse strengths and preparation. Many of our incoming MSE students do not have backgrounds in Chemical and Biomolecular Engineering, and we celebrate that these students have chosen JHU's program to start their journey in ChemBE! To help these students excel, we recommend they take some undergraduate-level courses to better prepare themselves for the core courses, especially for those who aspire to advance to a PhD program. However, these valuable preparatory courses ***do not count*** towards your graduate-level course requirements.

Core 1: Thermodynamics

- EN.540.202 Introduction to Chemical and Biological Process Analysis, typically offered both Fall and Spring semesters, recommended to be taken in your first semester. (Students would then take EN.540.671 Advanced Thermodynamics in Practice in spring semester)

AND

- EN.540.203 Engineering Thermodynamics, typically offered both Fall and Spring semesters, recommended to be taken in Spring semester after EN.540.202 (concurrently with EN.540.671).
- Students with sufficient background in Thermodynamics and/or Physical Chemistry, as well as Calculus II, can get approval from the Director of Masters' Studies to go directly to EN.540.671.

Core 2: Transport

- EN.540.303 Transport Phenomena I, typically offered both Fall and Spring semesters, recommended to be taken in your first semester. Students would then take EN.540.604 Advanced Transport Phenomena in Practice in their second semester)
- Students with sufficient background in Transport, as well as Calculus III and Differential Equations, can get approval from the Director of Masters' Studies to go directly to EN.540.604.

Core 3: Kinetics

- EN.540.301 Kinetic Processes, typically offered in Spring, is recommended to be taken in a student's second semester.
- Students with sufficient background in Thermodynamics and/or Physical Chemistry, as well as Calculus III and Differential Equations, may obtain approval from the Director of Masters' Studies to go directly to EN.540.673 and EN.540.681.
- Students with sufficient background in Thermodynamics and/or Physical Chemistry, Calculus II and Differential Equations, *and* Kinetics, may obtain approval from the Director of Masters' Studies to go directly to EN.540.673 and EN.540.681.

In addition to these three Core areas of preparation, some students may wish to supplement their mathematical background prior to registering for graduate coursework, by taking one or more of the following:

- AS.110.109 Calculus II (For Physical Sciences and Engineering)
- AS.110.202 Calculus III
- AS.110.302 Differential Equations and Applications
- EN.553.291 Linear Algebra and Differential Equations.

Consult with the Director of Masters' Studies to plan your course schedule and ensure to finish all your degree requirements on time.

Technical Writing Requirement[2]

As part of their MSE coursework, students must take at least one of the Technical Writing Course options offered by the CLE Department. These courses were chosen specifically for relevance to Chemical Engineering professionals, and they count towards the required 30 (Coursework based) or 18 (Essay or Design based) credits:

- EN.663.613 Technical Communication for Scientists and Engineers
- EN.663.640 Writing Grant and Contract Proposals
- EN.663.644 Writing for Clarity
- EN.663.645 Improving Presentation Skills for Graduate Students

[2] For students who completed their undergrad at JHU and took EN.661.315 Culture of the Engineering Profession, the Technical Writing Requirement is waived.

Combined BS/MSE Program and Students with BS in ChemBE from Johns Hopkins

ChemBE undergraduates may wish to continue into the MSE program concurrently with or after their BS studies. Students in their junior year may apply to the Combined BS/MSE program, and students in their senior year may apply directly to the MSE program.

Any ChemBE undergraduate, regardless of desire to pursue an MSE, is allowed to take graduate level courses, as long as they have met the prerequisites and get instructor approval. This means that students do not need to rush to complete their undergraduate coursework to get a head-start on the MSE coursework; they should focus on taking courses in the proper order to solidify their foundational knowledge.

Note that the BS and MSE programs are separate entities, even though they exist in the same department. If you have not yet completed your undergraduate coursework, you are recognized as an undergraduate by the university for all policies that depend on student status. Also, if some or all of your coursework towards the MSE is completed while an undergraduate, you will need to submit your undergraduate transcript along with your graduation materials, as the MSE team may not have access to any undergraduate records.

Double-Counting Policy

Courses may be allowed to count towards both the BS and the MSE; however, the ChemBE graduate program's policy on double-counting is stricter than the WSE policy found here: https://engineering.jhu.edu/education/graduate- studies/graduate-academic-policies-procedures/

Students pursuing both their undergraduate and masters' degrees in ChemBE at JHU, and students who have already received their BS in ChemBE at JHU, should be aware of the department's rules:

- Up to 2 courses may count towards requirements for both the BS and MSE degrees.
- For classes offered at both the 400 and 600 level, students MUST take the course at the 600 level to apply the course to their Masters' degree. This cannot be changed after the course has been completed.
- If BS/MSE students take more than two 600-level courses and do not need them for BS graduation requirements (i.e., the BS degree audit places these excess courses in the "Reserved for Master's Degree" category), they can count them towards the completion of their MSE degree. (Confirm with the Director of Undergraduate Studies that your audit has placed your courses how you wish BEFORE your BS graduation is finalized.)
- Courses in which the student earns a grade of B- or lower cannot be double-counted.

Course Exemptions

As noted above, students with a BS in ChemBE from Johns Hopkins may substitute for both advanced versions of Core 1 Thermodynamics and Core 2 Transport. Also, students are exempt from the Lab Safety requirement if they took EN.540.490 Introduction to Chemical Process Safety and from the Technical Writing Elective requirement if they took 661.315 Culture of the Engineering Profession. These requirements are thus waived as opposed to being double-counted. Students must still take the full number of required graduate-level course credits (18 for essay/design-based students and 30 for course-based students)

Additional Program Requirements

In addition to completing the required coursework at the appropriate levels, students earning the MSE in ChemBE must maintain good academic standing and fulfill other program requirements ed below.

Good Academic Standing

- Students must maintain a B average (GPA 3.0) in coursework to remain in good academic standing and earn their degree.
- Note that while undergraduate courses will not count towards GPA, C+ or below grades in those courses will count towards academic standing.
- Courses in which students earn less than a C- cannot be counted toward degree requirements; however, these courses can be retaken.
- In any given semester, receiving **one** grade of D or F, or **two** C's, will result in the student being placed on academic probation (C-, C, and C+ all count as C grades).
- Once a student is placed on probation, any additional grade of C+ or below will result in the student's termination from the program.
- A student will remain on academic probation until they improve their D or F grade upon retake or earn a grade of C- or better in a Director-approved substitution.
- While on academic probation, a student is assigned a case worker for support. A student on probation will meet with the Director of Masters' Studies to discuss progress approximately midway through the semester for which they are on probation.

Calculating GPA

A student's GPA is calculated based on the graduate-level coursework counted towards their degree, decided by the courses that appear on the MSE Checklist. Thus, at any given time, if a student has fewer graduate-level credits than the minimum requirement, all graduate-level courses will count towards the GPA. If a student has exceeded the minimum credit requirement, the subset of courses that meet all graduation requirements will count towards the GPA. A student can choose to have more courses than the minimum appear on the MSE Checklist.

This means that if a student gets a C+ or below in a course, they have one of two options: (1) Retake the course for a higher grade, in which case the new grade will replace the old one immediately; or (2) Take additional courses such that this course in question is not needed towards graduation and will therefore not be counted. If a student is on academic probation for coursework performance, Option 1 will likely resolve the probation more quickly than Option 2.

Note that while undergraduate courses will not count towards GPA, C+ or below grades in those courses will count towards academic standing and will appear on the student's transcripts.

Additional Requirements for Essay-based Students

To maintain full-time registration, students must always be registered for at least 9 credits per semester. Therefore, in semesters during which essay-based students pursue research, they must register for as many credits as necessary of their advisor's research course (EN.540.801) to maintain the 9 total credits required. (For example, a student taking one 3-credit course would register for 6 credits of research with their advisor to maintain 9 credits for full-time status.)

Students in the essay-based MSE should earn ***at least*** 12 research credits during their degree program.

Essay-based students must remain in good research standing with their research advisor. Failure to do so will result in probation and possible transfer to the course-based MSE. Essay-based students must write an essay based on original research and literature review and present their results at an open seminar attended by faculty and students. The essay must be approved by the departmental graduate committee, which consists of at least (1) the graduate research advisor and (2) a faculty member, one of which must be a faculty member from the Department of Chemical and Biomolecular Engineering (primary or secondary appointment). (See "Essay Presentation" below for details.

Alternatives to Conducting Research On-Campus

As an alternative to conducting on-campus research in a faculty member's lab, MSE students may complete the essay program by securing an internship or co-op position in industry that provides them with an opportunity to engage in graduate-level research. Students should have guidance from the Director of Masters' Studies as they apply for such positions and students should generally not conduct an internship or co-op until they have completed the other degree requirements, including all coursework.

Prior to committing to an internship or co-op, students must obtain:

1. **Written confirmation from a representative of the company or organization offering the internship or co-op position, indicating that research undertaken as part of the internship or co-op will result in materials that can be published.** MSE culminating essays are required to be published in the Sheridan Library's Electronic Thesis and Dissertation portal, and some companies will not permit research to be published without redactions or sometimes at all. Therefore, in this fashion. It is also important that the position is one that will offer a sufficiently high level of research to build skill and knowledge, and earn degree credit (i.e. not a position that is mostly related to administrative work or other non-research tasks). Although in rare cases an essay can be embargoed (delayed), it is preferred that MSE essays are publishable when submitted upon completion of the student's program requirements.
2. Students must also find a primary ChemBE faculty member to supervise them and support them in completing their research and essay. In general, students will meet with this advisor at least once every six weeks during the internship or co-op to ensure that the research and writing are progressing. The advisor will need to write a letter of support when the student applies for non-resident (NR) status for the relevant semester(s).

For support in locating internships and co-ops, and developing professional materials and conducting interviews, students can reach out to Mark Savage, Associate Director & Life Design Educator for Engineering Masters & EP Students, and attend workshops and events on campus that will be advertised through email.

Many ChemBE students have also found research-based MSE appropriate internships and co-ops through the INBT Industry Co-Op Program. For more information, please visit https://inbt.jhu.edu/masters/ or contact David Lee (dlee254@jhu.edu).

Non Resident (NR) Status

During course registration for the semester a student goes on co-op or internship, complete paperwork to go on "Non-Residential Student" status. This reduces your tuition for that semester, as you will not be on campus. However, it is Whiting School of Engineering policy that students on NR status cannot take courses, even online-only, while on NR status.

Please find the relevant forms here. Note that the supporting student and faculty letters are required. When the form and letters are complete, the student should send them to the Academic Program Administrator for submission for additional approvals and processing.

Essay Presentation

The typical MSE essay presentation is conducted in front of the student's advisor, a second reader or advisor, and is open to attendance by any faculty member. The student's "first reader" will be their advisor, and their "second reader" will be a faculty member chosen by the advisor and student. At least one of these two readers must have an appointment (primary or secondary) in the ChemBE department. The essay should be provided to the advisor and second reader at least two weeks prior to the presentation date.

Students present their work at an open seminar attended by the committee members, which will be publicized to the department. To publicize the presentation, students should contact the Academic Program Administrator as soon as the presentation date and time have been agreed upon. The APA can assist with room scheduling and/or Zoom meetings, and the APA will publicize the event for the department. There is no closed examination period after the essay presentation.

A "Readers Letter" indicating that the student's research and essay have been approved by their advisor and second reader for completion of their degree program requirements is required to be included in an MSE student's degree conferral paperwork. Students should request this letter from the Academic Program Administrator at least two weeks prior to their presentation (this can be at the same time that the presentation is arranged and publicized). Advisors and readers may choose not to sign the readers letter if the research and essay are not of sufficient quality. In addition, prior to signing, either the advisor or the reader, or both, may require the student to revise the essay. For these reasons, it is imperative that the student maintain active communication with the advisor and reader during their research and essay-writing process, as noted above.

International students should contact OIS at least eight weeks prior to their presentation date to ensure that their visa status and application for their EAD card and Optional Practical Training are in place.

Students must submit their final essay to the library's ETD (Electronic Theses and Dissertations) database. Refer to the *Guidelines for the Preparation of Dissertations and Theses*, which can be found online at https://www.library.jhu.edu/library-services/electronic-thesesdissertations/ . Once submitted, students must forward the library's approval to the MSE Academic Program Administrator as part of their graduation materials. The approval will come in the form of an email titled, "**Your ETD submission is approved**."

Steps for Graduation

- Notify the MSE Academic Program Coordinator **before your final semester** if you intend to graduate. Scheduling the essay presentation can take up to six weeks, and other important materials need to be exchanged.
- Contact OIS if you are an international student. OPT applications must be created three months before completion of your degree.
- Complete the “Application for Graduation” in SIS by the announced deadline. If the deadline is missed, a form must be completed and approved and sent in through SEAM with the assistance of the Academic Program Administrator.

Note: If no “Application for Graduation” is on file in the registrar’s office, the student will not be included on the degree candidates list signed by the President. Should a student’s degree requirement materials be received after the deadlines listed above, that student’s name will be added to the next semester’s Graduate Board list for completed degrees.

Example Course Schedules

Example Course Schedule 1: Essay-Based Students with BS in ChemBE

Semester 1 (Fall)		Semester 2 (Spring)	
EN.540.604	Advanced Transport Phenomena in Practice (Core 2)	EN.540.671	Advanced Thermodynamics in Practice (Core 1)
EN.540.602 OR EN.540.6xx	Metabolic Systems Biotechnology (Core 3 option for Focus Area 1) OR Elective or Focus Area Elective (3-4 credits)	EN.xxx.6xx	Elective or Focus Area Elective (3-4 credits) OR EN.540.673 Advanced Chemical Reaction Engineering in Practice (Core 3) OR EN.540.681 Molecular Kinetics & Catalysis (Core 3)
EN.663.6xx	Technical Writing Option	EN.xxx.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.600	ChemBE Seminar	EN.500.601	Lab Safety
EN.540.801	Graduate Research (1 credit)		

Semester 3 (Fall)		Semester 4 (Spring)	
EN.xxx.6xx	Elective (3 credits)	EN.540.801	Graduate Research (Essay and Presentation)
EN.540.801	Graduate Research		

Example Course Schedule 2: Essay-Based Students without BS in ChemBE

Semester 1 (Fall)		Semester 2 (Spring)	
EN.540.202	Intro to Process Analysis (pre- Core 1)	EN.540.671	Advanced Thermodynamics in Practice (Core 1)
EN.540.303	Transport Phenomena I (pre-Core 2)	EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)	EN.540.301	Kinetic Processes (pre-Core 3)
EN.540.600	ChemBE Seminar (can be taken any semester)	EN.540.203	Engineering Thermodynamics (co-Core 1)
EN.663.6xx	Technical Writing Elective	EN.500.601	Lab Safety
Semester 3 (Fall)		**Semester 4 (Spring)**	
EN.540.602	Metabolic Systems Biotechnology (Core 3)	EN.540.801	Graduate Research
EN.540.604	Advanced Transport Phenomena (Core 2)		
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)		
EN.540.801	Graduate Research		

Example Course Schedule 3: Course-Based Students with BS in ChemBE

Semester 1 (Fall)	
EN.540.604	Advanced Transport Phenomena in Practice (Core 2)
EN.540.602 OR EN.540.6xx	Metabolic Systems Biotechnology (Core 3) OR Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.801	Graduate Research (1 credit)
EN.540.600	ChemBE Seminar (can be taken any semester)

Semester 2 (Spring)	
EN.540.671	Advanced Thermodynamics in Practice (Core 1)
EN.540.673 OR EN.540.681 OR EN.540.6xx	Adv Chemical Reaction Engineering in Practice OR (Core 3) OR Molecular Kinetics and Catalysis (Core 3) OR Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.500.601	Lab Safety
EN.633.6xx	Technical Writing Elective (*can be Elective 10 if 3 cr eq)

Semester 3 (Fall)	
4 x EN.540.6xx	4 Electives or Focus Area Electives (3-4 credits each)

Example Course Schedule 4: Course-Based Students without BS in ChemBE

Semester 1 (Fall)

EN.540.202	Intro to Process Analysis (pre- Core 1)
EN.540.303	Transport Phenomena I (pre-Core 2)
EN.540.801	Graduate Research (1 credit)
EN.633.6xx	Technical Writing Elective
EN.540.600	ChemBE Seminar (can be taken any semester)

Semester 2 (Spring)

EN.540.671	Advanced Thermodynamics in Practice (Core 1)
EN.540.604	Advanced Transport Phenomena in Practice (Core 2)
EN.540.301	Kinetic Processes (pre-Core 3)
EN.540.203	Engineering Thermodynamics (co-Core 1)
EN.500.601	Lab Safety

Semester 3 (Fall)

EN.540.602	Metabolic Systems Biotechnology (Core 3)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)

Semester 4 (Spring)

EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)
EN.540.6xx	Elective or Focus Area Elective (3-4 credits)

Additional Useful Policies and Resources

Laboratory Safety

The importance of laboratory safety cannot be overstated. All students are required to complete the safety course prior to beginning work in the lab. This course is offered in the fall and spring semester. Any BS/MSE students who have already taken the undergraduate version of the course and are not required to take it. It should be noted that the laboratory safety course does not cover everything one needs to know regarding safety in each individual lab but is intended to create a safety-minded experience through which the student will be able to evaluate their own lab for potential safety issues and to determine how he/she would respond in that situation.

Students working with either biological hazards and/or radiation are required to take additional appropriate courses through the medical campus.

Annual departmental and university laboratory inspections are conducted by the departmental safety officer and university safety officer. Random laboratory checks are also conducted.

Some relevant contact information for safety issues:

1. ChemBE Faculty Safety Officer Rebecca Schulman, rschulm3@jhu.edu

2. Homewood Laboratory Safety Advocate
   Daniel R. Kuespert, (410) 516-5525, dkuespert@jhu.edu
   https://labsafety.jhu.edu/author/dkuespe1/

3. Emergency Resources https://labsafety.jhu.edu/emergency-resources/

4. JHU University-Wide Health, Safety & Environment
   https://www.hopkinsmedicine.org/hse/offices_and_programs.html
   https://www.hopkinsmedicine.org/hse/
   https://www.hopkinsmedicine.org/hse/policies/index.html

Relevant Security and Safety Phone Numbers

JHU Security
Emergency: (410) 516-7777 (24/7)
Non-emergency: (410) 516-4600 (24/7)

Other Important Numbers
Health, Safety, and Environment: (410) 516-8798 (business hours)
Maryland Poison Center: (800) 222-1222 (24/7)
JHU Radiation Safety: (410) 516-7278
JHU Biosafety: (410) 955-5918
JHMI Needlestick Hotline: (410) 955-STIX (5pm-8am) Blue Jay Shuttle: (410) 516-5121 (24/7)
Plant Operations: (410) 516-8063
Occupational Health Services: (410) 516-0450 Student
Health Services: (410) 516-8270

MSE Active Student Communications Policy

The predominant channel through which MSE Program Leadership communicates with MSE students is email. After you activate your JHU email address, the MSE Program Coordinator will add your email to a listserv, and department leadership will use email to disseminate deadlines, updates, policies, opportunities, and other forms of communication that are critical for students' success in the program. **To ensure consistent and reliable communication of information, all active ChemBE MSE Students must remain subscribed to this listserv during their time in the program.**

Continuing to the PhD Program

Many students hope to pursue a PhD at some institution after completing their MSE, so here are some tips on how to make the best use of your time in our program:

- Pursue the essay-based MSE. Conducting research as part of your MSE requirements demonstrates that you understand what a life of research is like and that you can balance research and coursework.

- Connect with your faculty advisor. You will likely be applying for PhD programs during your third semester, so if your advisor is aware of your ambitions, they can help you get a strong start to your research and start thinking early about their letters of recommendation for your application. Note that it is not an expectation that you will have a publication by the time you graduate with your MSE, let alone in time for PhD application submission, so your work ethic, critical thinking skills, and teamwork with your fellow labmates are what your advisor will be able to comment on.

- Do well in your coursework, especially your core courses. If you demonstrate success in graduate work at our program, that signifies that you will do well at your next school.

While we do not guarantee that it will be possible for a student to continue on to a PhD in our department after completing their MSE, many students have converted from an MSE to a PhD through their faculty advisor, who, after monitoring their work for a year or more, agrees to take you on for a PhD. Here are some tips that worked for these select students:

- Choose a primary ChemBE faculty as your primary advisor. While we do allow faculty with secondary appointments in ChemBE to advise MSE students without needing a coadvising situation, they will not have the same power to keep students on for a ChemBE PhD, since their primary appointment is not in our department.

- Discuss this possibility during the matching process. Some faculty create MSE projects that are "high risk, high reward", projects that are proof-of-concept but don't yet have funding, and/or projects that are more exploratory and are good for a student's work for two years but not for five. If a faculty does not have the funding or desire to continue the project that you are working on, that decreases your chances of a jump from MSE to PhD.

- Discuss this possibility again during the summer after your first year. This will make sure everyone is in agreement about the move (sometimes things change), and if it is looking like you will not be able to stay, then you have ample time to prepare a PhD application for another school, and your advisor will whole-heartedly support your application.

If you secure a move from MSE to PhD, here are some steps to follow:

1) Formally apply for the PhD through the application portal. By Hopkins policy, all students need to have an application on file for anything to be processed.
2) Meet with the Director of PhD Studies to discuss which of the courses that you took can be used to waive PhD course requirements.
3) Submit your MSE checklist to the Director of Masters' studies and the MSE Academic Coordinator to ensure that you are on track to complete all the MSE requirements before starting your PhD, by department policy.
4) Complete your coursework and essay requirements, including presentation. The MSE and PhD Academic Coordinators will then process an internal degree transfer from MSE to PhD.
5) We will not submit your MSE degree conferral materials until you are ready to leave our program, with or without a PhD. This policy is for international students, who can better use their OPT time after leaving Hopkins. If you would rather receive your MSE right away, we can process it for you at that time.

Johns Hopkins Policy Information

https://engineering.jhu.edu/education/graduate-studies/

Registration Policies

Students are required to register for every semester of study. Registration deadlines will be published by the Registrar well in advance. It is the student's responsibility to check their account and make sure there are no holds in place to bar registration. For advisor holds, the student should speak to their advisor. For financial holds, the student should contact the Department Administrator. If a student misses the registration deadline, they are responsible for a late fee of $150-$300.

Students often register over the summer to avoid paying extra FICA taxes. The Academic Program Administrator will inform students about registration procedures and deadlines each semester, but students are responsible for determining if they should register in summer and for which courses. Students who miss the deadline will incur a late fee.

Graduate Board

The Graduate Board is responsible for the administration of University-wide policies and procedures for the award of Master of Arts; MA; Master of Sciences, MS; and Doctor of Philosophy, PhD.

Office of International Services (OIS)

The primary mission of the Office of International Services (OIS) is to assist international students, scholars, and faculty at Johns Hopkins University's Homewood Campus. OIS works with the academic and administrative departments to facilitate the immigration process.

Additionally, OIS' staff members are available to answer your questions about immigration status, financial concerns, health matters, housing, employment possibilities, as well as other issues that may arise during your stay. Please refer to http://ois.jhu.edu/.

For students needing advisor information prior to matriculation for visa-approval purposes, students can use the Director of Masters' Studies' information. Students should explain that the

Director of Masters' Studies will serve as their initial academic advisor on a temporary basis until the student matches with a research advisor once they arrive on campus. As such, students will not need to provide the Director of Masters' Studies' resume/CV for this process.

Health Insurance

All graduate students are required to carry sufficient health insurance. The University offers a low-cost health insurance plan for a reduced cost of $250 for MSE Students.

Students who are already under a plan through their parents or employer have the option to waive the JHU plan by filling out a waiver form and turning it in to the Registrar's Office. This must be done every year. Students who plan to choose this option must also notify the Academic Program Coordinator and Department Administrator. A copy of the waiver form must be turned in to the Department office and kept on file.

Whiting School of Engineering Academic Policies and Procedures

The Academic Policies & Procedures for All Whiting School of Engineering Full time Graduate students is available online and can be accessed using the following link: https://engineering.jhu.edu/graduate-studies/academic-policies-procedures-graduate/

Student Outreach and Support

The Office of the Dean of Student Life provides students with many forms of nonacademic support: https://studentaffairs.jhu.edu/student-life/ Students are encouraged to explore the many types of support available https://wellbeing.jhu.edu/

The case manager designated to support ChemBE MSE students is Chase Oatis; they are available by email to coatis1@jhu.edu or by phone (410) 615 2328. Case managers can help students obtain excused absences for medical reasons, support students in obtaining a Medical Leave of Absence, can assist with mental health concerns, and more. Students who need immediate assistance should contact emergency services any time 24/7: https://studentaffairs.jhu.edu/counselingcenter/our-services/crisis-and-emergency-services/

Additional support available includes a food pantry and emergency funds: https://studentaffairs.jhu.edu/student-life/student-outreach-support/

Graduate Student Conflict Resolution

The Department of Chemical and Biomolecular Engineering endeavors to provide a supportive environment for its graduate students. When the occasional problem arises, and students need help resolving an issue, the department recommends these steps:

- The student can talk to their faculty/research advisor.
- The student can attempt to resolve the conflict by having an in-person conversation with the involved parties. If the student is uncomfortable with this or needs assistance with

these discussions, there are faculty members (in addition to the Department Head, Jennifer Elisseeff) who are prepared to help and can be contacted for their assistance:

- Director of Masters' Studies, Eric Husmann
- MSE Academic Program Administrator, Sonya Brown
- Director of Masters' Admissions, Chao Wang

Students can also reach out for assistance beyond the department; several offices on campus can help students resolve various issues:

- Whiting School of Engineering Office of Academic Affairs
- GRO (Graduate Representatives Organization)
- JHU Counseling Center
- JHU Office of Institutional Equity
- Office of the Dean of Student Life
- Homewood Graduate Affairs and Admissions Office
- Office of Student Disability Services

If the situation is serious and cannot be reasonably resolved through any of these options, the Whiting School has a grievance policy, and we will stand with the student to help if a formal complaint is appropriate.

ChemBE Department Information

Up-to-date information on the department is available on our website at:
https://engineering.jhu.edu/chembe/

The web link for our core faculty is:
https://engineering.jhu.edu/chembe/faculty/

The link for joint/secondary appointed faculty is:
https://engineering.jhu.edu/chembe/people/secondary-appointment-2/

Graduate Student Liaison Committee (GSLC)

The Graduate Student Liaison Committee represents the graduate student body in the Department. The group is a voice for all graduate students and works to create a cohesive work and social environment in Chemical and Biomolecular Engineering. The GSLC also organizes social, athletic, and professional events that bring together faculty, graduate students, and undergraduates on a regular basis. These events include our annual Halloween social, Thanksgiving potluck, and Orioles' game. Follow us on social media for updates:

https://www.facebook.com/ChemBEGSLC/ https://www.instagram.com/chembe_gslc_jhu/

We are always looking for motivated representatives! If you are interested, please contact the GSLC president found at https://engineering.jhu.edu/chembe/gslc/

Department Staff

Our department staff is listed on our department website:
https://engineering.jhu.edu/chembe/people/staff/

Department Office and Mailing Address

Department of Chemical and Biomolecular Engineering
Maryland Hall 230
Johns Hopkins University
3400 N. Charles Street
Baltimore, Maryland 21218, USA

Mail and Supplies Policies

Laboratories are responsible for procuring their own supplies and managing their own shipping accounts (FedEx). Each lab should have a person designated to oversee such purchases and track budget spending.

A multi-function photocopier is also available for student use in 230 for tasks related to the conduct of research or the academic pursuits of the faculty. This printer will only scan and send to @jhu.edu e-mail addresses.

Additional Useful JHU Links

Office of the Registrar
https://studentaffairs.jhu.edu/registrar/
75 Garland Hall

JCard Services (JHU Student ID)
https://studentaffairs.jhu.edu/jcard/
3100 Wyman Park Drive

Student Financial Services
https://finaid.jhu.edu/
146 Garland Hall

Student Accounts
https://studentaffairs.jhu.edu/student-accounts/
31 Garland Hall

Office of Student Disability Services
https://studentaffairs.jhu.edu/disabilities/
385 Garland Hall

Office of Institutional Equity
http://oie.jhu.edu
Wyman Park Building Suite 515

Ralph O'Connor Recreation Center
http://web.jhu.edu/recreation/

Community Living (Housing)
https://studentaffairs.jhu.edu/community-living/

JHU Sheridan Libraries
https://www.library.jhu.edu/

Homewood Student Affairs
https://studentaffairs.jhu.edu

Digital Media Center
https://studentaffairs.jhu.edu/dmc/

Campus Security
http://www.jhu.edu/~security/ Campus Police: (410) 516-7777

Security Office: (410) 516-4600

Safety Escort Services
Phone: (410) 516-4600

JHU Transportation Services (including parking)
http://ts.jhu.edu

Barnes & Noble Bookstore
http://johns-hopkins.bncollege.com
JHU Charles Commons

Office of International Services (visas, etc.)
http://ois.jhu.edu

JHU Information Technology
http://www.it.johnshopkins.edu

Graduate Representative Organization (GRO)
https://studentaffairs.jhu.edu/gro/

JHU Career Center
https://studentaffairs.jhu.edu/careers/