

Department of Chemical and Biomolecular Engineering



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Welcome to the Master of Science in Chemical Engineering (MS) program at Rice!

The MS program is a thesis based program that seeks to prepare students for a career in the field of chemical engineering. Opportunities for new graduates span industries focused on energy, (petro)chemical, materials, biotechnology, environment and safety; of course, the MS degree can also be a stepping-stone for pursuing a doctorate.

Students with a Bachelor's degree in Chemical Engineering can complete the course work in two semesters. Research will typically span two an additional semesters. The curriculum also allows for students with a non-chemical engineering background to obtain the MS degree. For such students, additional semesters are needed in order to take foundational chemical engineering courses that would be expected of a student with a bachelor's degree in chemical engineering. Besides courses within the department, ample opportunities exist for students to take courses in other departments to fulfill degree requirements.

Our program places a strong emphasis on the overall professional development of the student. Students have opportunities to enhance their communication skills, understand engineering leadership and project management, and interact with industry representatives through seminars and career-development workshops.

Sample courses/plan given below should thus be treated only as a broad guideline to get you started in fashioning your studies at Rice.

Our heartiest best wishes as you embark on a new adventure!

Program Overview

1. Students need to complete a minimum of 30 credit hours of course work plus research credits for the MS program
2. Students need to complete a minimum of 18 hrs (6×3 -credit hours) of CHBE courses which include five (5) core courses noted below and one (1) CHBE elective
 - Students with a non-Chemical Engineering Undergraduate degree are required to take core undergraduate chemical engineering courses, but these will not count towards the degree
3. Students are required to take the following core graduate chemical engineering courses
 - a) Thermodynamics (CHBE 611)
 - b) Transport (CHBE 501 and CHBE 602)
 - c) Kinetics (CHBE 590)
 - d) Applied Numerical Methods (CHBE 505)
4. Students must write and defend a thesis on original research work conducted under the guidance of a faculty in the department.
5. Students will typically complete a minimum of 12 credit hours of CHBE 700 (research) under the appropriate faculty mentor for the MS
6. Students must maintain a grade of B- or better in each course
7. Students must meet the residency requirement

Program Policies and Procedures

1 Advising Meetings

Before registering for courses, students are required to meet with program Director and confirm their plans. Students should come prepared with a concise and clean write-up of their plans for the coming semester and notes/observations about their (evolving) career plans. The Program Director will maintain an electronic record of the advising meeting. The student must inform the Program Director of any course selection updates made after the advising meeting. Unapproved course changes may not be certified by the Program Director.

2 Selecting Advisers

Students in the MS program are required to work on an original thesis under the guidance of a faculty mentor in the CHBE department. During the first semester in residence department faculty members will present their research topics to the first-year graduate students. Each student must meet with a minimum of three faculty members for detailed discussions on the research topics of most interest to him/her. Presentations will be given by faculty members who are available for selection as an adviser.

The department will strive to match the preference of each student to those of the faculty and to available research projects. Students will be notified by the end of the first semester of their adviser appointment. Students whose adviser's primary appointment is in a different department will be required to follow the requirements outlined in these guidelines. The student is expected to keep both the thesis adviser and the MChE/MS program Director apprised of their course-work related plans.

3 Graduate Student Mentors

In-coming MS students will be paired with a senior MS or PhD student who will serve as their mentor. The student mentors serve an essential role in ensuring the well-being of the in-coming students, helping them settle into the program, and serving to transmit the "senior's wisdom." It is up to the student to make the best use of their time with their student-mentors.

4 Seminar Series

The seminar series is a vital part of the overall graduate learning experience. The department hosts a seminar speaker each week during the fall and spring semesters. All MS students are required to register for the graduate seminar course, CHBE 661 (Fall) and CHBE 662 (Spring) each semester in residence. Prior approval must be requested to the Graduate Studies Committee and the MChE/MS Program Director to obtain an excused absence. More than two (2) unexcused absences will result in an unsatisfactory seminar grade for the semester. In addition, prior approval must be obtained from the Graduate Studies Committee before registering for a class that conflicts with the CHBE seminar course. Students should subscribe to the department seminar mailing list (ow.ly/oOSsb) to make sure they receive the weekly seminar announcements.

5 Teaching Requirements

Students in the MS program receiving a stipend from the department are expected to complete two semesters as teaching assistant.

6 Satisfactory Progress

MS students are expected to make continuous and satisfactory progress towards fulfilling the degree requirements. Students must maintain a grade of B- or better in each course and also make satisfactory progress in their research work. Consistently failing to make satisfactory progress may lead to the student being dismissed from the program. In accordance with university policy (see General Announcements at ga.rice.edu) students whose CGPA falls below 2.67 or the semester GPA falls below 2.33 are placed on probationary status. University policy further states that any student placed on probationary status for a second semester will lead to an automatic dismissal by the Office of Graduate and Postdoctoral Studies, unless the student's department presents a plea for exception that is approved by the Dean of Graduate and Postdoctoral Studies.

7 Candidacy, Oral Examination, and Thesis

Requirements for achieving candidacy towards a thesis Master's degree are determined at the department level. This includes satisfactory completion of all course requirements and designation of the student's thesis committee. The thesis committee is comprised of at least three members and must meet the criteria as outlined in the General Announcements at ga.rice.edu and with input from their faculty mentor. The student is responsible for completion of the Master's Candidacy Petition. Within the CHBE department, this workflow is handled through the Academic Program Administrator. The student is expected to coordinate with the Program Administrator to ensure the petition is submitted. The thesis committee that will examine the thesis work prepared by the student. The public oral defense of a thesis is intended to be an examination of a completed body of work and should be scheduled only when the thesis is essentially completed. Students may take the final oral examination in defense of their thesis only after the dean of graduate and postdoctoral studies approves their candidacy.

8 Degree Works

Degree Works is a web-based, degree-auditing and tracking tool that will enable a student to evaluate academic progress toward graduation. Within Degree works, the student should be able to identify quickly which degree requirements have been completed and which requirements are outstanding, thus ensuring that courses selected apply to requirements as expected. Students may access Degree Works at registrar.rice.edu/students/dw_instructions/

The coursework and research hours needed for the degree, once confirmed in degree works, will enable the student to be confident in the candidacy application required for the degree process as stated in Section 7 of this policy. The MS adviser and MS Program Director will concur certification of all requirements.

9 Transfer to the MChE program

On occasion students in the research program elect to transfer to the non-thesis MChE program. Such transfers will need to meet the requirements of the MChE program. The student is expected to work with the program director to ensure all program requirements are satisfied. In particular, the student will need to complete a minimum of 30 credit hours of course work. For students who have already done research, we will only count up to 3 credits of research in lieu of Independent Study (CHBE 695).

10 Degree Conferral

Students can graduate at the end of the Fall, Spring, or Summer semesters. In order to qualify for a given commencement, students must meet the submission deadline for commencement per the appropriate Academic Calendar. Please confirm your plans well in advance of the deadline with the program Director.

11 Rice University Policies Applicable To All Graduate Students

11.1 Leaves Of Absence

All graduate students are expected to maintain continuous enrollment, unless an official leave of absence has been granted. Failure to register for any period without a leave of absence granted by the Associate Provost constitutes *de facto* withdrawal. If a student later wishes to resume study, reapplication is required. Readmission is given only on the recommendation of the department and the approval of the Associate Provost.

A leave of absence is granted by the Office of Graduate and Postdoctoral Studies upon the recommendation of the department and that too only to a student in good standing with the university. Leave must be approved in advance of the academic semester in question; it will not be granted after the student has registered for courses or after the registration period has passed. Normally, a leave of absence is granted for no more than two consecutive semesters. No work toward a degree may be done at Rice or involve Rice faculty (or facilities) during a student's leave of absence.

11.2 Residency Requirement And Part-time Status

Semester course load for full-time students is nine (9) hours. Minimum residency for schools of engineering is one Fall or Spring semester in full time or part time graduate study. Students dropping below the nine hours and registering for at least three hours are considered part-time. Students who wish to obtain part-time status must notify and obtain written permission from the MChE Director and the Academic Coordinator before the semester begins. A part-time status request will then be sent to the Office of Graduate and Postdoctoral Studies for final approval.

International students must obtain approval from the Office of International Students and Scholars (OISS) before dropping below the minimum hours required for full-time students; the request for approval is made by presenting a completed Reduced Course Load Authorization Form found on the OISS webpage. International students must verify with the department that this process has been completed with OISS before the formal request can be made to the Office of Graduate and

Postdoctoral Studies. To maintain legal immigration status, international students are allowed to go part-time only in their final semester of study.

As a part-time student the tuition paid will be based on the number of registered hours times the hourly tuition rate. Rates are found in the General Announcements/Tuition, Fees & Expenses at ga.rice.edu. Students are assessed a one-time per semester part-time enrollment fee of \$150 when enrolled for less than 9 credits.

12 Guidelines For Dismissals, Petitions, Appeals, Grievances, And Problem Resolution

Rice University graduate students have guidelines to assure fairness in problem resolution. These policies strive to uphold standards and raise the quality of graduate programs. They provide graduate students with an environment that has high standards, clear assessments of the student's achievements and fair and transparent procedures for handling cases of inadequate academic progress. Please find the complete list of guidelines in the General Announcements for graduate students at ga.rice.edu. These guidelines are to be followed by all Rice graduate students. The CHBE Graduate Studies Committee will be the standing committee for all issues regarding these guidelines.

13 Title IX Sexual Misconduct Policy

Rice encourages any student who has experienced an incident of sexual, relationship, or other interpersonal violence, harassment or gender discrimination to seek support. There are many options available both on and off campus for all graduate students, regardless of whether the perpetrator was a fellow student, a staff or faculty member, or someone not affiliated with the university.

Students should be aware when seeking support on campus that most employees are required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to Title IX professionals on campus who can act to support that student and meet their needs. The therapists at the Rice Counseling Center and the doctors at Student Health Services are confidential, meaning that Rice will not be informed about the incident if a student discloses to one of these Rice staff members. Rice prioritizes student privacy and safety, and only share disclosed information on a need-to-know basis. If you are in need of assistance or simply would like to talk to someone, please call Rice Wellbeing and Counseling Center, which includes Title IX Support: (713)348-3311.

Policies, including Sexual Misconduct Policy and Student Code of Conduct, and more information regarding Title IX can be found at safe.rice.edu.

14 Honor System

Students take all written examinations and complete any specifically designated assignments under the honor system. By committing themselves to the honor system, all students accept responsibility for assuring the integrity of the examinations and assignments conducted under it. The Graduate Honor Council (GHC) is responsible for investigating reported violations and for conducting a hearing when the facts warrant. The Office of Student Judicial Programs, which reviews the results of the investigations and hearings, considers the GHC's recommendations when issuing penalties. Procedures for accusations arising out of summer classes or Rice Online classes may differ.

Course Options and Suggested Plans

15 CHBE Course Options

Our course offerings are periodically updated. The list below are typical course offerings within the department. Courses marked with an asterisk are required. Please note that only one of CHBE 505 or CHBE 692 is required.

1. CHBE 501 (Fall) Fluid Mechanics and Transport Processes*
2. CHBE 505 (Spring) Advanced Numerical Methods* (can be taken in lieu of CHBE 692)
3. CHBE 590 (Fall) Advanced Reaction Engineering*
4. CHBE 602 (Spring) Physicochemical Hydrodynamics*
5. CHBE 611 (Fall) Advanced Thermodynamics*
6. CHBE 503 (Fall) Design Fundamentals
7. CHBE 506 (Fall/Spring) Decision Tools for Chemical Engineers
8. CHBE 515 (Spring) Separation Processes
9. CHBE 516 (Spring) Structure and Properties of Polymers and Soft Materials
10. CHBE 518 (Fall) Material Physics and Solid State Devices
11. CHBE 519 (Spring) Atomistic Simulation Methods and Engineering Applications
12. CHBE 523 (Fall) Bioengineering Systems and Control
13. CHBE 552 (Fall) Energy Resources
14. CHBE 558 (Fall) Genome Editing and Engineering
15. CHBE 560 (Spring) Colloidal and Interfacial Phenomena (offered even years)
16. CHBE 594 (Spring) Properties of Polymers (offered odd years)
17. CHBE 603 (Fall) Rheology (not offered every year)
18. CHBE 615 (Fall) Application of Molecular Simulation and Statistical Mechanics
19. CHBE 634 (Fall) Surface Analysis Methods
20. CHBE 571 (Spring) Flow and Transport Through Porous Media I (offered odd years)
21. CHBE 671 (Spring) Flow and Transport Through Porous Media II (offered even years)
22. CHBE 695 (Fall/Spring) Independent Study

For students entering with a non-Chemical Engineering background the following courses are required (unless specific waivers are granted on a case-by-case basis)

1. CHBE 390 (Fall) Kinetics & Reactor Design
2. CHBE 401/402 (Fall/Spring) Transport Phenomena I and II
3. CHBE 411/412 (Spring/Fall) Thermodynamics I and II
4. CHBE 503 (Fall) Design Fundamentals — will count towards MChE requirements

16 Possible Electives

The list below is simply to give you a flavor for what is available within Rice.

16.1 BIOE (Bioengineering)

1. BIOE 535 (Fall) Engineering Cell-based Therapeutics for the Treatment of Diseases
2. BIOE 518 (Spring) Introduction to Computational Biology
3. BIOE 554 (Fall) Computational Fluid Mechanics
4. BIOE 548 (Fall) Neural Signal Processing
5. BIOE 589 (Fall) Computational Molecular Bioengineering/Biophysics

16.2 CAAM (Computational and Applied Mathematics)

1. CAAM 519 (Fall) Computational Science I
2. CAAM 520 (Spring) Computational Science II
3. CAAM 552 (Fall) Finite Element Methods
4. CAAM 536 (Spring) Numerical Methods for PDEs
5. CAAM 564 (Spring) Numerical Optimization
6. CAAM 583 (Fall) Introduction to Random Processes and Applications

16.3 CHEM (CHEMISTRY)

1. CHEM 530/531 (Fall/Spring) Quantum Chemistry/Advanced Quantum Chemistry
2. CHEM 533 (Spring) Nanoscience and Nanotechnology
3. CHEM 554 (Fall) Drug Discovery

16.4 CEVE (Civil & Environmental Engineering)

1. CEVE 502 (Fall) Sustainable Design
2. CEVE 507 (Spring) Energy and The Environment
3. CEVE 510 (Fall) Principles of Environmental Engineering
4. CEVE 534 (Fall) Fate and Transport of Contaminants in the Environment
5. CEVE 535 (Spring) Physical and Chemical Processes For Water Quality Control
6. CEVE 536 (Spring) Environmental Biotechnology
7. CEVE 592 (Fall) Modeling and Analysis of Networked Systems
8. CEVE 520 (Spring) Environmental Remediation and Restoration

16.5 ECON (Economics)

1. ECON 504 (Fall) Computational Economics
2. ECON 601 (Fall) Energy Economics I

Please talk to the instructor before registering for ECON courses.

16.6 ESCI (EARTH SCIENCE)

1. ESCI 544 (Spring) Hydrocarbon Exploration
2. ESCI 549 (Fall) Data Management and Data Governance
3. ESCI 570 (Fall) Computational and Data Science in the Energy Industry
4. ESCI 672 (Fall) Earth systems modeling
5. ESCI 699 (Fall) Visual Design For Scientists

16.7 ELEC (ELECTRICAL & COMPUTER ENGINEERING)

1. ELEC 535 (Fall) Information Theory
2. ELEC 578 (Fall) Introduction to Machine Learning
3. ELEC 585 (Fall) Fundamentals of Medical Imaging I
4. ELEC 587 (Fall) Introduction to Neuroengineering
5. ELEC 680 (Spring) Nano-neurotechnology

16.8 ENGI (ENGINEERING)

1. ENGI 510 (Spring) Technical and Managerial Communication
2. ENGI 515 (Fall/Spring) Leading Teams and Innovation
3. ENGI 530 (Fall/Spring) Engineering Practicum
4. ENGI 542 (Spring) Communication for Engineers
5. ENGI 545 (Spring) Strategic Thinking
6. ENGI 601 (Fall) Engineering Communications Workshop
7. ENGI 610 (Fall) Management for Science and Engineering
8. ENGI 614 (Fall; 2 credit) Learning how to innovate?
9. ENGI 615 (Fall/Spring) Leadership coaching for engineers

16.9 MSNE (Material Science and Nanoengineering)

1. MSNE 502 (Fall) Mechanical Properties of Materials
2. MSNE 505 (Spring) Microstructure and Nanostructure Evolution
3. MSNE 510 (Spring) Scaling concepts in 2D materials and Polymer physics
4. MSNE 523 (Fall) Design of composite materials
5. MSNE 533 (Spring) Computational Materials Modeling
6. MSNE 569 (Spring) Corrosion science and engineering

16.10 PHYS (Physics)

1. PHYS 521 (Fall) Quantum Mechanics I
2. PHYS 533/534 (Fall/Spring) Nanostructure and nanotechnology I/II
3. PHYS 551 (Fall/Spring) Biological Physics

16.11 RCEL (Rice Center for Engineering Leadership)

1. RCEL 501 (Fall & Spring) Engineering Management & Leadership
2. RCEL 502 (Fall & Spring) Engineering Project Management
3. RCEL 504 (Fall & Spring) Ethical-technical Leadership
4. RCEL 505 (Fall & Spring) Leading Engineering Economics
5. RCEL 506 (Fall & Spring) Applied Statistics and Data Science for Engineering Leaders
6. RCEL 542 (Fall) Professional Communication

16.12 STAT (Statistics)

1. STAT 515 (Spring) Data Science Consulting
2. STAT 525 (Fall) Bayesian Statistics
3. STAT 604 (Fall) Computational Economics
4. STAT 605 (Fall/Spring) R for Data Science (computing heavy)
5. STAT 682 (Fall) Quantitative Financial Analytics

17 Sample Plans

17.1 Three (3) Semester Plan Emphasizing Chemical Engineering Fundamentals

Fall 1 st Semester	Spring 2 nd Semester	Summer	Fall 3 rd Semester
CHBE 501	CHBE 602		
CHBE 590	CHBE 611	CHBE 700 [‡]	CHBE 700
CHBE 505 (Elective)	CHBE Elective CHBE 700		(defend thesis)

[‡]Students may be able to take CHBE 700 over the summer break after confirming with their faculty mentor.

17.2 Four (4) Semester Plan that allows students more time to explore a sub-discipline

Fall 1 st Semester	Spring 2 nd Semester	Summer	Fall 3 rd Semester	Spring 4 th Semester
CHBE 501	CHBE 602		CHBE Elective	CHBE 700
CHBE 590	CHBE 611	CHBE 700 [‡]	CHBE 700	(defend thesis)
CHBE 505 (Elective)	(CHBE 700) (Elective)			

[‡]Students may be able to take CHBE 700 over the summer break after confirming with their faculty mentor.

The outline above is meant as a guide to fashion a program of study with an emphasis on a sub-discipline. The four semester plan is what most students choose.