

Chemical and Biomolecular Engineering



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Professional Master's Program

It is our pleasure to welcome you to the Professional Master's (MChE) program at Rice.

The MChE program offers a non-thesis, professional degree intended to prepare students for a career in the field of chemical engineering. Opportunities for new graduates span industries focused on energy engineering, petrochemical, materials, biotechnology, and environment and safety.

Students with a Bachelor's degree in Chemical Engineering can complete the course work in two semesters. The curriculum also allows for students with a non-chemical engineering background to obtain the MChE 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.

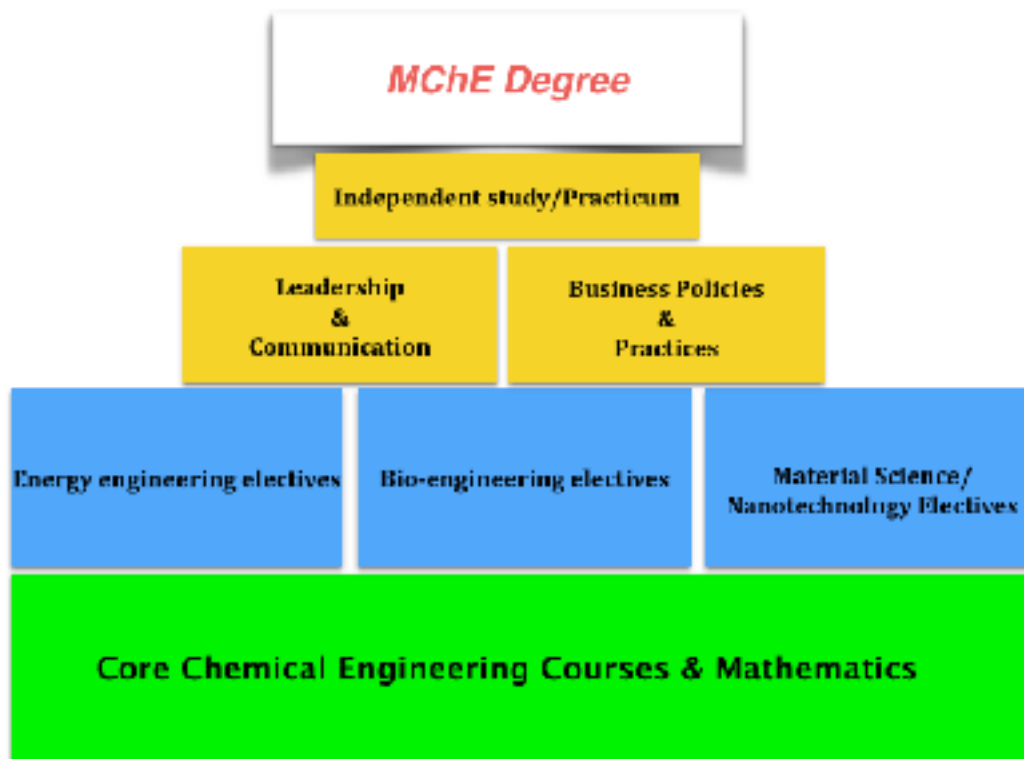
An important component of our program is the strong emphasis we place on the overall professional development of the student. Students will have opportunities to enhance their communication skills, understand engineering leadership and project management, and interact with industry representatives through seminars and career-development workshops offered under the aegis of the Professional Master's program at Rice.

We in the department and the university continuously seek to revise and adapt the curriculum to maintain the highest academic standards and better meet current and expected future industry needs. 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!

Chemical and Biomolecular Engineering

Program Structure & Course Requirements



- 1) Minimum of 30 hrs (**10** three-credit hour) courses at **500 level or higher**
- 2) MChE students **are required** to take the following core graduate chemical engineering courses: Thermodynamics (CHBE 611), Transport (CHBE 501, CHBE 602), Kinetics (CHBE 590), and Mathematics (CHBE 692)
 - (A) If a student has a compelling reason for wanting to opt out of a core course, the petition needs to be made to the MChE program Director. The final decision will be made by the Director in conjunction with the graduate studies committee.
- 3) Must maintain a grade of **B-** or better in each course.
- 4) Students must meet the residency requirement.

Of the 30 hrs noted above

- 5) Minimum of 18 hrs (**6** three-credit hour) CHBE courses which include the five (5) core courses and one Chemical Engineering elective
 - (A) Students with a non-Chemical Engineering Undergraduate degree need to take core undergraduate chemical engineering courses, but these will not count towards the MChE degree.
- 6) Minimum of 3 hrs (**1** three credit hour) approved mathematics training
- 7) Approved engineering, natural science, policy and management courses

Chemical and Biomolecular Engineering

Policies & Procedures

1. Advising meetings

Before registering for courses, students should meet with MChE Director and confirm their plans for the upcoming semester. 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. Students must bring their write-up to the advising meetings. The Program Director will maintain an electronic record of the advising meeting. The student must inform the Program Director each semester of any course selection updates.

2. Independent study (CHBE 695) and internships

CHBE 695 offered in Fall and Spring can be used to undertake independent study either in a research group in the department or outside in an industrial setting. Final decision on accepting the proposal for independent study and the number of credit hours to be assigned rests with the director of the MChE program (also the instructor for CHBE 695) and the chair of the graduate committee. A student may end up taking more than three (3) credits of CHBE 695 over their course of study at Rice, but only a maximum of 3 credits (or the actual credits if less than 3) will be counted towards the degree.

For off-campus independent study the student needs to first present an offer letter (from the company) stating clearly the work the student will pursue. The student needs to make an initial written presentation on how the work will contribute to his/her professional and intellectual development in Chemical and Biomolecular engineering. After approval by the Director of the MChE program, the student is required to turn in biweekly reports (duly signed by the off-campus supervisor) documenting their progress. For such off-campus independent study, the student may accept appropriate financial support from the company offering the internship. Foreign students additionally need to have a curricular practical training endorsement for off-campus work.

2.1 For Summer Internships under ENGI 530,

- (a) Locate an appropriate internship and secure an offer letter
- (b) Discuss the position with the MChE director to ensure this is appropriate practical training and agree upon appropriate work samples that you will need to provide for us to evaluate your work. You will also need an industrial mentor to monitor and evaluate your progress.
- (c) After these steps, the MChE Director will confirm the plans with Dean Bart Sinclair who leads ENGI 530. **You should then print and sign the ENGI 530 student agreement form and deliver it to Dean Sinclair** (Duncan Hall 1016; please contact Ms. Pamela Traylor — pt3@rice.edu — for an appointment).
- (d) International students, should also complete the form to request CPT authorization (available from OISS) and take it to Dean Sinclair for signature, since it is under ENGI 530 that you will do the internship.

Chemical and Biomolecular Engineering

Policies & Procedures

3. Seminar Series

The department hosts a seminar speaker each week during the fall and spring semesters. Per the *PhD Policies and Procedures* all PhD graduate students must register for the graduate seminar course, CHBE 661 (Fall) and CHBE 662 (Spring) each semester in residence. MChE students may register for the seminar course and receive the 1 hour course credit to count toward their degree required hours, if needed. All students registering for the class must be in attendance to receive the credit hour(s). Prior approval must be requested to the Graduate Studies Committee and the MChE Program Director to obtain an excused absence. **More than two (2) unexcused absences will result in an unsatisfactory seminar grade for the semester.** Students should subscribe to the department seminar mailing list (ow.ly/oOSsb) to make sure they receive the weekly seminar announcements and notify the Academic Program Administrator of their enrollment in the seminar course.

4. Satisfactory progress

MChE 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. 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.

5. Degree Certification

The MChE Program Director will certify Masters student degrees as complete in Degree Works, a web-based, degree-auditing and tracking tool that will enable a student to evaluate academic progress toward graduation. A student will be able to identify quickly which degree requirements have been satisfied and which requirements are outstanding. Final certification must be completed in a timely manner once a student files an application for degree conferral with the Office of the Registrar.

Students may access Degree Works at registrar.rice.edu/students/dw_instructions/ .

Chemical and Biomolecular Engineering

Policies & Procedures

6. 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 MChE Director.

7. Transfer to the MS Program/PhD program

The MChE degree is a terminal degree. Ideally, after graduation, students should plan to pursue their career either in industry, or, for greater and more diverse intellectual enrichment, in a **different academic institution**. Students who wish to pursue a PhD in Chemical and Biomolecular Engineering at Rice must apply afresh to be considered for the doctoral program. Note that only in **exceptional cases** will such students be admitted to the Chemical and Biomolecular doctoral program here at Rice.

MChE students who have undertaken independent study with a faculty in the department, can with input from their faculty mentor, apply to switch to the thesis-based MS program. On a case-by-case basis based on inputs from the faculty mentor and the Director of the MChE program, the graduate committee may allow the student to switch to the MS program.

8. Rice University policies applicable to all graduate students

8.1 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 only by the Office of Graduate and Postdoctoral Studies upon the recommendation of the department, and is granted only to students 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, 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.

Chemical and Biomolecular Engineering

Policies & Procedures

8.2 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 Graduate and Postdoctoral Studies for final approval.

International students must obtain approval from the Office of International Students and Scholars before dropping below the minimum hours required for full-time students by completing the *Reduced Course Load Authorization Form* found on the OISS webpage oiss.rice.edu/forms/. International students must verify with the department that this process has been completed with OISS before the formal request can be made to GPS. **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.

9. 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.

Chemical and Biomolecular Engineering

Policies & Procedures

10. 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.

Chemical and Biomolecular Engineering

CHBE Course Options

Our course offerings are continuously updated. The list below offers some suggestions on courses that are standardly given in the department. Courses marked with an asterisk are **required**.

- 1) CHBE 501 (Fall) Fluid Mechanics and Transport Processes*
- 2) CHBE 503 (Fall) Design Fundamentals
- 3) CHBE 505 (Fall) Advanced Numerical Methods*
 - (a) Required starting Fall 2019
- 4) CHBE 523 (Fall) Bioengineering Systems & Control
- 5) CHBE 550 (Fall) Petroleum phase behavior and flow assurance
- 6) CHBE 555 (Spring) Two-phase flow & multiphase flow
- 7) CHBE 560 (Spring) Colloidal and Interfacial Phenomena (offered even years)
- 8) CHBE 570 (Fall) Industrial Catalysis and Petrochemical Processes
- 9) CHBE 580 (Fall) Protein Engineering
- 10) CHBE 590 (Fall) Advanced Reaction Engineering*
- 11) CHBE 594 (Spring) Properties of Polymers (offered odd years)
- 12) CHBE 602 (Spring) Physicochemical Hydrodynamics*
- 13) CHBE 603 (Fall) Rheology (not offered every year)
- 14) CHBE 611 (Spring) Advanced Topics — Thermodynamics*
- 15) CHBE 615 (Fall) Application of molecular simulation and statistical mechanics
- 16) CHBE 620 (Spring) Tissue Engineering
- 17) CHBE 634 (Fall) Surface Analysis Methods
- 18) CHBE 640 (Fall) Metabolic Engineering
- 19) CHBE 571 (Spring) Flow and transport through porous media I (offered odd years)
- 20) CHBE 671 (Spring) Flow and transport through porous media II (offered even years)
- 21) CHBE 682 (Spring) Systems Biology of human diseases
- 22) CHBE 692 (Fall) Applied Mathematics for Chemical Engineering*
 - (a) to be removed from list of required courses starting Fall 2019
- 23) CHBE 695 (Fall/Spring) Independent Study

For students entering with a non-Chemical Engineering background the following courses would be **required** (unless we determine otherwise 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 (Fall/Spring) Thermodynamics I and II
- 4) CHBE 503 (Fall) Design Fundamentals — course **will** count towards MChE degree requirements

Chemical and Biomolecular Engineering

Possible Electives

(to give a flavor of what is available at Rice)

BIOE (Bioengineering)

- 1) BIOE 502 (Fall) Physical Biology
- 2) BIOE 506 (Fall) Synthetic Biology
- 3) BIOE 518 (Spring) Introduction to Computational Biology
- 4) BIOE 554 (Fall) Computational Fluid Mechanics
- 5) BIOE 589 (Fall) Computational Molecular Bioengineering/Biophysics

CAAM (Computational and Applied Mathematics)

- 1) CAAM 508 (Fall) Nonlinear systems: Analysis and Control
- 2) CAAM 535 (Fall) Modeling Mathematical Physics
- 3) CAAM 550 (Fall) Numerical Analysis
- 4) CAAM 553 (Fall) Advanced Numerical Analysis I

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

EARTH SCIENCE

- 1) ESCI 672 (Fall) Earth systems modeling: Numerical techniques and applications (course covers applying basic numerical methods using Matlab and COMSOL)

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

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 (**internship must be identified before enrolling**)
- 4) ENGI 542 (Spring) Communication for Engineers
- 5) ENGI 545 (Spring) Strategic Thinking

Chemical and Biomolecular Engineering

Possible Electives

(to give a flavor of what is available at Rice)

ENGINEERING (Contd.)

- 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) Leadership coaching for engineers

MSNE (Material Science and Nanoengineering)

- 1) MSNE 502 (Fall) Mechanical Properties of Materials
- 2) MSNE 505 (Spring) Microstructure and Nanostructure Evolution
- 3) MSNE 506 (Fall) Physical Properties of Solids
- 4) MSNE 510 (Spring) Scaling concepts in 2D materials and Polymer physics
- 5) MSNE 523 (Fall) Design of composite materials
- 6) MSNE 533 (Spring) Computational Materials Modeling
- 7) MSNE 569 (Spring) Corrosion science and engineering

PHYS (Physics)

- 1) PHYS 517 (Spring) Computational Physics
- 2) PHYS 533 (Fall) Nanostructure and nanotechnology I
- 3) PHYS 534 (Spring) Nanostructure and nanotechnology II

STAT (Statistics)

- 1) STAT 605 (Fall) R for Data Science (**computing heavy, but R is an excellent tool to learn**)
- 2) STAT 615 (Fall) Regression and Linear Models
- 3) STAT 682 (Fall) Quantitative Financial Analytics
- 4) STAT 699 (Fall) Computational Finance

Chemical and Biomolecular Engineering

CHBE 692 alternatives

CHBE 692 covers an excellent range of topics that is helpful for any researcher. It is also a required course for our doctoral students. Starting Fall 2018, we are offering an applied mathematics course, Advanced Numerical Methods CHBE 505, that has a more practical flavor that would be suited for the Master's student. Starting Fall 2019, this course will be the required mathematics for students in the MChE program; at that point CHBE 692 will be removed as an alternative.

For scheduling flexibility, the department is open to allowing students matriculating in 2018 to take a comparable course in another department. Please discuss with the program Director before making your choice.

Chemical and Biomolecular Engineering

Sample MChE Plans

For a program with emphasis on only chemical engineering fundamentals, we show both a “relaxed” schedule and a two-semester program for students with a strong Chemical engineering background.

1) MChE with emphasis on Chemical Engineering fundamentals

Fall (1st Semester)	Spring (2nd Semester)	Summer	Fall (3rd Semester)
CHBE 501	CHBE 560 or CHBE 594	ENGI 530 (Engineering Practicum)	Elective
CHBE 590	CHBE 602		Elective
CHBE 692 or a suitable alternative from another department	CHBE 611		
Elective	CEVE 528 or a suitable Economics/Policy/Management Course		

Fall (1st Semester)	Spring (2nd Semester)
CHBE 501	CHBE 560 or CHBE 594
CHBE 590	CHBE 602
CHBE 611	CHBE 692
Math elective	CEVE 528 or a suitable Economics/Policy elective
CHBE elective (e.g., CHBE 550 / CHBE 580) or course from another department	CHBE 593 or 603 (if offered) or suitable elective from another departments

Chemical and Biomolecular Engineering

Sample MChE Plans

3) MChE with focus on Energy Engineering

Fall (1st Semester)	Spring (2nd Semester)	Summer	Fall (3rd Semester)
CHBE 501	CHBE 560	ENGI 530 (Engineering Practicum)	Energy Policy/ Economics elective
CHBE 590	CHBE 602		CEVE 505
CHBE 692	CHBE 611		CHBE 593 or 603 (if offered)
CHBE 550 / CHBE 570	CHBE 571 or CHBE 671		CHBE 695

4) MChE with focus on Bioengineering

Fall (1st Semester)	Spring (2nd Semester)	Summer	Fall (3rd Semester)
CHBE 501	CHBE 611	ENGI 530 (Engineering Practicum)	BIOE 543
CHBE 640	CHBE 602		Project Management or similar elective suitable to the Biotech Industry
CHBE 590	CHBE 620		Elective
CHBE 580 / CHBE 523	BIOE 518		CHBE 695

Chemical and Biomolecular Engineering

Sample MChE Plans

5) MChE with focus on Material Science and Nanotechnology

Fall (1st Semester)	Spring (2nd Semester)	Summer	Fall (3rd Semester)
CHBE 501	CHBE 560 or CHBE 594	ENGI 530 (Engineering Practicum)	Policy/Economics elective
CHBE 590	CHBE 602		CEVE 505
CHBE 611	PHYS 534 / ELEC 565		CHBE 593 or 603 (if offered)
MSNE 502 / MSNE 506 / PHYS 533	ELEC 680		Math elective
			CHBE 695