

# 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 nonthesis, 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.

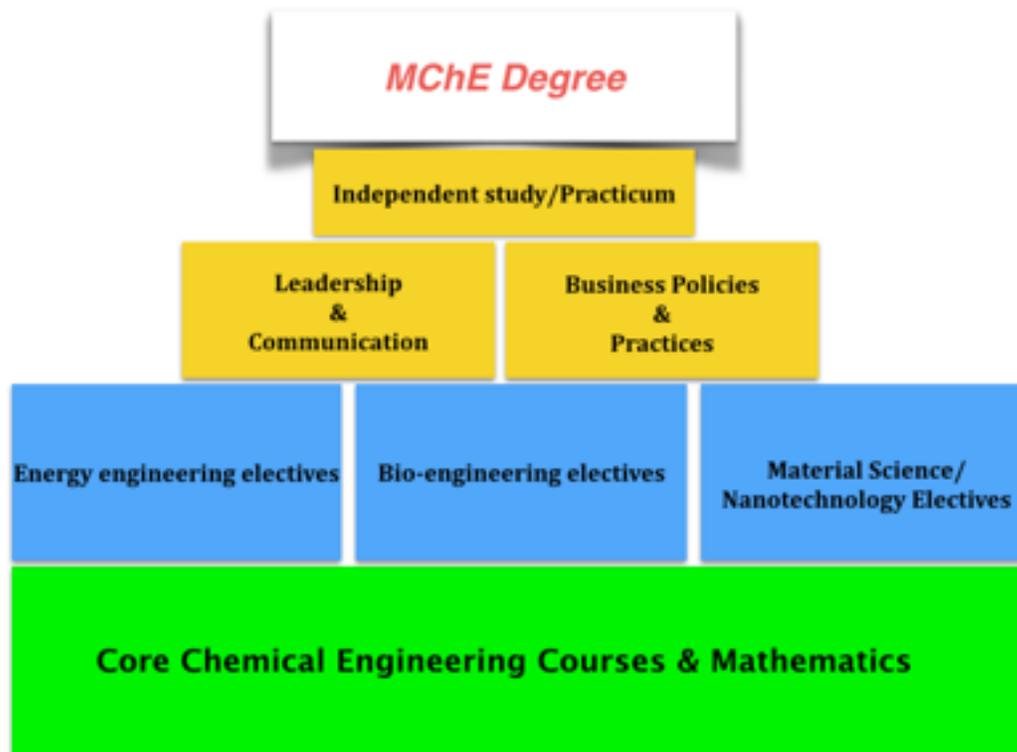
An important component of our program is the strong emphasis we place on the overall professional development of the student. Students will have opportunities to enhance their communication skills, understand engineering leadership and project management, and interact with industry representatives through 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
  - (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
- 8) A minimum of 24 credit hours must be completed at Rice

# 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. You should also complete the MChE degree audit checklist and bring it to the advising meetings. (The degree audit checklist can be obtained by clicking on this [link](#).)

### 2. Independent study (CHBE 695) and internships

The CHBE 695 course 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**, the student needs to do the following:

- (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 Professor Sinclair.**
- (d) International students, should also complete the form to request CPT authorization (available from OISS) and take it to Professor Sinclair for signature, since it is under ENGI 530 that you will do the internship.

# Chemical and Biomolecular Engineering

## Policies & Procedures

### 3. 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](http://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.

### 4. Time Boundaries

Students in non-thesis master's degree programs, including professional master's programs, must submit a certification of non-thesis master's through the department chair to the Office of Graduate and Postdoctoral Studies. Master's students must be approved for candidacy before the beginning of the fifth semester of their enrollment at Rice. In order to qualify for a given commencement, students must meet the submission deadline for commencement per the Academic Calendar. The calendars can be found at [registrar.rice.edu](http://registrar.rice.edu).

### 5. Degree conferral

Students can graduate at the end of the Fall, Spring, or Summer semesters. Please confirm your plans well in advance of the deadline with the MChE Director. Students need to confer with the Departmental Coordinator to initiate submission of the petition for Certification of Non-Thesis Master's degree.

### 6. 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 inputs 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.

# Chemical and Biomolecular Engineering

## Policies & Procedures

### 7. Rice University policies applicable to all graduate students

#### 7.1 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.

#### 7.2 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 Department 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/](http://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](http://ga.rice.edu).

# Chemical and Biomolecular Engineering

## Policies & Procedures

### **8. 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 [www.ga.rice.edu](http://www.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.

### **9. 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](http://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 523 (Fall) Bioengineering Systems & Control
- 4) CHBE 550 (Fall) Petroleum phase behavior and flow assurance
- 5) CHBE 555 (Spring) Two-phase flow & multiphase flow
- 6) CHBE 560 (Spring) Colloidal and Interfacial Phenomena (offered even years)
- 7) CHBE 570 (Fall) Industrial Catalysis and Petrochemical Processes
- 8) CHBE 580 (Fall) Protein Engineering
- 9) CHBE 590 (Fall) Advanced Reaction Engineering\*
- 10) CHBE 594 (Spring) Properties of Polymers (offered odd years)
- 11) CHBE 602 (Spring) Physicochemical Hydrodynamics\*
- 12) CHBE 603 (Fall) Rheology (not offered every year)
- 13) CHBE 611 (Spring) Advanced Topics — Thermodynamics\*
- 14) CHBE 615 (Fall) Application of molecular simulation and statistical mechanics
- 15) CHBE 620 (Spring) Tissue Engineering
- 16) CHBE 640 (Fall) Metabolic Engineering
- 17) CHBE 571 (Spring) Flow and transport through porous media I (offered odd years)
- 18) CHBE 671 (Spring) Flow and transport through porous media II (offered even years)
- 19) CHBE 682 (Spring) Systems Biology of human diseases
- 20) CHBE 692 (Fall) Applied Mathematics for Chemical Engineering\*
- 21) 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 518 (Spring) Introduction to Computational Biology
- 3) BIOE 523 (Fall) Control theory and Systems/synthetic biology
- 4) BIOE 543 (Fall) DNA Biotechnology, Biophysics, and Modeling
- 5) BIOE 552 (Fall) Introductory computational systems biology
- 6) BIOE 554 (Fall) Computational Fluid Mechanics
- 7) BIOE 589 (Fall) Computational Molecular Bioengineering/Biophysics

### **CAAM (Computational and Applied Mathematics)**

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

### **CEVE (Civil & Environmental Engineering)**

- 1) CEVE 501 (Fall) Environmental Chemistry
- 2) CEVE 502 (Fall) Sustainable Design
- 3) CEVE 505/ENGI 505 (Fall) Engineering Project Management & Economics
- 4) CEVE 528 (Spring) Engineering Economics

### **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 571 (Fall) Imaging at the Nanoscale
- 3) ELEC 580 (Fall) Introduction to Neuroengineering: measuring and manipulating neural activity
- 4) ELEC 585 (Fall) Fundamentals of Medical Imaging I

### **ENGINEERING**

- 1) ENGI 505 (Fall) Engineering Project Management and Economics
- 2) ENGI 515 (Fall) Leading Teams and Innovation
- 3) ENGI 530 (Fall/Spring) Engineering Practicum (**internship must be identified before enrolling**)

# Chemical and Biomolecular Engineering

## Possible Electives

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

### **ENGINEERING (Contd.)**

- 4) ENGI 610 (Fall) Management for Science and Engineering
- 5) ENGI 614 (Fall; **2 credit**) Learning how to innovate?
- 6) ENGI 615 (Fall) Leadership coaching for engineers

### **ENST (Environmental Studies)**

- 1) ENST 613 (Fall) Sustainable Design

### **MSNE (Material Science and Nanoengineering)**

- 1) MSNE 502 (Fall) Mechanical Properties of Materials
- 2) MSNE 506 (Fall) Physical Properties of Solids
- 3) MSNE 523 (Fall) Design of composite materials

### **PHYS (Physics)**

- 1) PHYS 516 (Fall) Mathematical Methods
- 2) PHYS 517 (Spring) Computational Physics
- 3) PHYS 533 (Fall) Nanostructure and nanotechnology I
- 4) PHYS 534 (Spring) Nanostructure and nanotechnology II
- 5) PHYS 551 (Fall) Biological Physics
- 6) SSPB 501 (Fall) Physical Biology

### **POST (Policy Studies)**

- 1) POST 501 (Fall) Energy Policy.

### **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

## Possible Substitutes for CHBE 692

**CHBE 692 covers an excellent range of topics that is helpful for any engineer and is a required course for our doctoral students. However, considering the scheduling flexibility that MChE students can use, the department is open to allowing MChE students to take a comparable course in another department.**

**Some possible alternatives are noted below.**

- 1) CAAM 523 (Fall) Partial differential equations I
- 2) CAAM 536 (Spring) Numerical Methods for PDEs
- 3) CAAM 550 (Fall) Numerical Analysis
- 4) CAAM 553 (Fall) Advanced Numerical Analysis I
- 5) CAAM 554 (Spring) Advanced Numerical Analysis II
- 6) PHYS 516 (Fall) Mathematical Methods
- 7) PHYS 517 (Spring) Computational Physics

# Chemical and Biomolecular Engineering

## Sample MChE Plans

We are working on trying to have Independent Study/Engineering Practicum as a course possibility. We will keep you updated on developments in this regard. 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)	Fall (3rd Semester)
CHBE 501	CHBE 560 or CHBE 594	Elective
CHBE 590	CHBE 602	Elective
CHBE 611	CHBE 692	
Math elective or some course from another department	CEVE 528 or a suitable Economics/Policy/Management Course	

### 2) MChE 2-semester plan with emphasis on Chemical Engineering fundamentals

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)	Fall (3rd Semester)
CHBE 501	CHBE 560	<b>Energy Policy/Economics elective</b>
CHBE 590	CHBE 602	<b>CEVE 505</b>
CHBE 611 / CHBE 615	CHBE 692	CHBE 593 or 603 (if offered)
<b>CHBE 550 / CHBE 570</b>	<b>CHBE 571 or CHBE 671</b>	
	<b>Possible Independent Study</b>	<b>Possible Independent Study</b>

### 4) MChE with focus on Bioengineering/Biophysics

Fall (1st Semester)	Spring (2nd Semester)	Fall (3rd Semester)
CHBE 501 or CHBE 590	CHBE 560 or CHBE 594	<b>BIOE 543</b>
<b>CHBE 640</b>	CHBE 602	Project Management or similar elective suitable to the Biotech Industry
CHBE 611	<b>CHBE 620</b>	Elective
<b>CHBE 580 / CHBE 523</b>	<b>BIOE 518</b>	Elective
	<b>Possible Independent Study</b>	<b>Possible Independent Study</b>

# Chemical and Biomolecular Engineering

## Sample MChE Plans

### 5) MChE with focus on Material Science and Nanotechnology

Fall (1st Semester)	Spring (2nd Semester)	Fall (3rd Semester)
CHBE 501	CHBE 560 or CHBE 594	<b>Policy/Economics elective</b>
CHBE 590	CHBE 602	<b>CEVE 505</b>
CHBE 611	<b>PHYS 534 / ELEC 565</b>	CHBE 593 or 603 (if offered)
<b>MSNE 502 / MSNE 506 / PHYS 533</b>	<b>ELEC 680</b>	Math elective
	<b>Possible Independent Study</b>	<b>Possible Independent Study</b>