

RENSSELAER POLYTECHNIC INSTITUTE

School of Engineering

Chemical &
Biological
Engineering

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Department of Chemical & Biological Engineering

<http://cbe.rpi.edu/>

The major educational objective in the Howard P. Isermann Department of Chemical and Biological Engineering is to prepare students to enter their engineering practice dealing with chemical as well as physical processes to meet the challenges for the future. The curriculum, which builds on chemistry, biology, mathematics, basic sciences, and engineering science, culminates in professional applications in which theory is tempered by engineering art and economic principles. Through this curriculum, graduates are prepared equally well for professional practice or for advanced study.

Opportunities for creative and satisfying practice in chemical and biological engineering can be found in conception, design, control, or management of processes involving chemical and/or biochemical transformations. These processes range from the more conventional conversion of crude oil into petrochemicals and plastics, to the development of novel processes for the production of biopharmaceuticals, to the creation of lab on chip devices using nanomaterials. The chemical conversion of resources into new, more useful forms has been the traditional concern of chemical engineers. In recent years there has developed a critical concern with the depletion of resources, leading to increased efforts to conserve, recycle, and find alternatives. Concurrently with high-technology advances in biochemical and semiconductor processing, these developments pose challenges that fall on the chemical engineering profession.

An undergraduate degree that works! Our chemical engineering graduates are well prepared for advanced graduate study and for professional practice. The companies employing Rensselaer chemical engineering graduates during the past decade are;

Amgen (biopharmaceuticals),
BioGen-IDG (biopharmaceuticals),
Centocor (biopharmaceuticals),
ExxonMobil (oil and chemicals),
General Electric (plastics),
Human Genome Sciences (biopharmaceuticals),
IBM (semiconductors),
Intel (semiconductors),
Millipore (biopharmaceuticals),
Merck (pharmaceuticals), and
Procter & Gamble (consumer products)

Diverse career choices exist not only in the chemical industry, but in virtually all processing industries, including agricultural, biotechnology, biomedical, chemical, food, nuclear, semiconductor processing, and environmental operations. By emphasizing basic principles, the program prepares its graduates for positions spanning the spectrum of activities from research and development, to process and project engineering, to production, or to technical marketing. Chemical engineering also provides an excellent background for entering medical school and law school.

Contact List for ChBE

<u>Department Head:</u>	Shekhar Garde (gardes@rpi.edu)	RI 102	
<u>Assistant to Dept. Head:</u>	Rose Primett (primer@rpi.edu)	RI 102	
<u>Undergraduate Advising:</u>	Class of 2015 Joel Plawsky (plawsky@rpi.edu)		CBIS 3211
	Class of 2015 Shekhar Garde (gardes@rpi.edu)		CBIS 4209
<u>URP and Work Study Coordinator:</u>	Sharon Sorell (sorels@rpi.edu)	RI 104	
<u>Undergraduate Degree Clearance Officer:</u>	B. Wayne Bequette (bequette@rpi.edu)	RI 129	
<u>Director of Graduate Programs:</u>	B. Wayne Bequette (bequette@rpi.edu)	RI 129	
<u>Graduate Admissions:</u>	Lee Vilarl (vilarl@rpi.edu)	RI 130	
<u>Business Administrator:</u>	Elaine Belokopitsky (beloke@rpi.edu)	JEC	

General Links:

Advising and Learning Assistance Center: <http://alac.rpi.edu/setup.do>
Center for Career & Professional Development: <http://rpi.edu/dept/cdc/>
Co-Op / Internships: <http://rpi.edu/dept/cdc/students/experience/coop/index.html>
Course Catalog: <http://www.rpi.edu/academics/catalog/>
International Programs: <http://undergrad.rpi.edu/update.do?catcenterkey=81>
Registrar Forms: <http://srfis.rpi.edu/update.do?catcenterkey=29>
Student Handbook: <http://www.rpi.edu/dept/doso/2006-2008RPI-StudentHandbook.pdf>
Student Information System: <http://sis.rpi.edu/>

Educational Objectives

1. Graduates will have a solid background in chemistry, mathematics, basic science, and engineering science.
2. Graduates will have a technical knowledge of fundamental chemical engineering concepts of balance equations, thermodynamics, transport phenomena, chemical reaction engineering, separations processes, and process systems engineering.
3. Graduates will be able to communicate technical material through written reports and oral presentations.
4. Apply chemical engineering principles and economic analysis to the synthesis of chemical processes and products. These complex problems require teamwork and the ability of individuals to serve as leaders and contributors.
5. Graduates will be prepared equally for professional engineering practice or further graduate study and be familiar with the ethical and safety guidelines governing their profession.
6. Graduates will be informed citizens, broadly educated in the humanities and social sciences and prepared for a process of lifelong learning.

Responsibilities

Student's responsibilities

- To know their advisor's office hours and advising schedule.
- To make an appointment and prepare for registration advising by reviewing the Catalog, Class-Hour Schedule, and Curriculum Advising & Program Planning (CAPP) Program.
- To formulate questions regarding curriculum, course selections, career options, etc.
- To be aware of their academic and personal needs and to seek assistance when needed.
- To understand that the role of their advisor is to advise them, not to make decisions for them. Each student needs to realize that it's his or her education at stake, and that, with advisement, *they* are ultimately responsible for making any final decisions.

Advisor responsibilities

- To be accessible to students throughout the year at posted office hours. If an advisor will be away from campus for an extended period of time, he or she should post the names and office locations of alternate advisors outside their offices, so that students will have other advising resources.
- To set aside designated times for registration advising and individual discussions.
- To be knowledgeable about current curriculum requirements, academic policies and procedures, referrals and resources on campus, and career opportunities in the major field.
- To guide students through academic programs that will complement their personal, educational, and professional interests.

Bachelor's Degree

The bachelor's degree is awarded to students who have pursued successfully, as evaluated by the faculty, a plan of study that encompasses several disciplines. Each plan of study has at least two objectives: first, to reach a pre-professional standing or fundamental mastery in a selected discipline; second, to develop some grounding in knowledge found in liberally educated persons, an appreciation of technology and science, and an openness to ongoing learning.

The requirements of each baccalaureate program are outlined as follows:

- The number of courses and credit hours is prescribed by each curriculum. Minimum requirements are 124 credit hours for science and for humanities and social sciences majors, 124 for management, **128 for engineering**, and 168 for the professional degree in the School of Architecture.
- The minimum grade point average (GPA) is **2.00**.
- To receive a baccalaureate degree, a student must have been admitted to the curriculum corresponding to the degree, must have satisfied the curriculum requirements, and must be enrolled in that curriculum at the time the degree is granted.
- The course content in physical, life, and engineering sciences must total a minimum of **24 credit hours**, including at least **eight credit hours** of mathematics. For information on additional requirements see the School of Science section of the course catalog.
- The course content in humanities and social sciences must total a minimum of **24 credit hours**, including at least **eight credit hours** in the humanities and **eight credit hours** in the social sciences. For information on additional requirements see the School of Humanities, Arts, and Social Sciences section of the course catalog.
- Every student is required to take at least **two** communication-intensive courses. At least one of these must be in the students' major and at least one of the courses must be writing intensive and taught in the School of Humanities, Arts, and Social Sciences.
- The minimum course concentration in the area of the selected discipline is prescribed by each curriculum but **cannot be less than 30 credit hours**.
- At least **24 credit hours are to be elective**, of which no less than **12 credit hours** are unrestricted electives.
- The student must be registered full-time for a minimum of four semesters. Two semesters of part-time study at Rensselaer will be considered equivalent to one semester of full-time study. In addition, the student must complete a minimum of **48 credit hours** at Rensselaer, all of which will be applied to the baccalaureate degree. If a transfer student elects to study abroad or enroll in the co-op program, no more than 12 such credits may apply to the 48 needed for the bachelor's degree. The student's Plan of Study at Rensselaer must include at least 16 credits of courses above the 1000 level in the major field, or in an approved concentration.

Academic Information and Regulations

The Institute requires a degree candidate to earn the last 30 credits in courses completed on this campus or through a program formally recognized by the Institute. Transfer courses are limited to two courses or eight credits counting toward the student's last 30 credits and require approval of the director of the Advising and Learning Assistance Center.

Baccalaureate candidates must have passed all of the prescribed academic work and have satisfied the fee requirements. Candidates must also be in good academic and disciplinary standing. Undergraduate students on probation at the time of completion of course work may be required to meet certain stipulations for removal from probation. However, such requirements may be waived for those students whose cumulative GPAs satisfy the baccalaureate degree requirements. In general, a term's work with grades of not less than C will be required in programs arranged by the Committee on Academic Standing. The director of the Advising and Learning Assistance Center will state requirements to the students in writing.

Degree candidates must be registered during the semester in which they intend to graduate and must file a degree application with the registrar by the dates specified in the academic calendar. Students who previously applied for graduation but did not complete all their requirements on time must submit a new application specifying the new date of graduation.

Required Courses for a B.S. in Chemical & Biological Engineering

ENGR 1100 Introduction to Engineering Analysis

An integrated development of linear algebra and statics emphasizing engineering applications and also incorporating computer exercises involving matrix techniques and calculations using available software packages.

Fall, spring, and summer terms annually. *4 credit hours*

ENGR 1200 Engineering Graphics and CAD

An introduction to the techniques for creating solid models of engineering designs. Topics include three-dimensional modeling of parts and assemblies, visualization, orthographic and isometric free-hand sketching, and computer-generated design documentation.

Fall, spring, and summer terms annually. *3 contact hours, 1 credit hour*

ENGR 1300 Engineering Processes

The use of basic machine tools such as lathes, milling machines, drill presses, band saws, and grinders, including micrometers, vernier calipers, and other devices of use in a machine shop or laboratory. Welding techniques and tool making are also considered.

Fall, spring, and summer terms annually. *1 credit hour*

ENGR 4010 Professional Development III

Students will study issues associated with working in teams in a modern work environment. Various styles of leadership, the definitions of power and empowerment and their applications in industry and team settings will be studied. Additionally, other topics to be explored include vision, values and attitudes, and organizational culture. The course format will include small and large group discussions, case studies, experiential exercises, and regular participation from industry guests.

Offered in conjunction with senior courses. *1 credit hour*

CHME 1010 Introduction to Chemical Engineering (Suggested Elective)

This is an elective course suitable for first year students interested in chemical engineering. It introduces students to the profession, including the technical content, career opportunities, and societal impact.

Fall term annually. *1 credit hour*

CHME 2010 Material, Energy, and Entropy Balances

Development of the ability to apply and solve equations of balance for chemical-process systems, laying the foundation for subsequent chemical engineering courses in unit operations and process design. Topics include process flowsheeting, mass and mole balances for nonreactive and reactive systems, properties of fluids, and the first and second laws of thermodynamics.

Fall term annually. *4 credit hours*

CHME 2020 Energy, Entropy, and Equilibrium

A continuation of CHME 2010. Topics include process flowsheeting, solution thermodynamics, phase equilibria, chemical-reaction equilibria, and applications of thermodynamics to problems in chemical-process design. One credit hour of this course is devoted to Professional Development. Prerequisite: CHME 2010.

Spring term annually. *4 credit hours*

CHME 4010 Transport Phenomena

An introductory course in transport phenomena covering fluid statics, and one-dimensional diffusive processes including laminar flow, heat conduction and mass diffusion. Course focuses on developing the equations of change, introducing sum-of-resistance concepts and couple fluid flow, heat transfer, and mass transfer problems. The concept of extended surfaces as a means of enhancing transport process is included. The course introduces numerical simulation concepts for solving simple, one-dimensional transport problems. Credit not allowed for both this course and ENGR 2250. Prerequisite: MATH 2400.

Fall term annually. *4 credit hours*

CHME 4020 Transport Phenomena II

A continuation of CHME-4010. Course includes topics on multi-dimensional transport processes, potential, boundary layer and turbulent fluid flows, convective heat and mass transfer processes, friction factors and drag in and around solid objects, heat and mass exchangers, and radiation heat transfer. The course extends the use of numerical methods to apply to multidimensional problems, convective heat and mass transfer problems and the simulation of more complicated fluid flows including turbulence approximations. Credit not allowed for both this course and ENGR-2250. Prerequisites: MATH 2400 and CHME 4010.

Spring term annually. *4 credit hours*

CHME 4030 Chemical Process Dynamics and Control

Introduction to modeling and control of dynamic chemical processes. Topics include the development of first-principles models, linearization and state space form, input/output (transfer function) form, design and tuning of PID controllers, model-based control, frequency response for robustness analysis, case studies in multivariable control, numerical analysis and simulation. Prerequisite: MATH 2400.

Spring term annually. *4 credit hours*

CHME 4040 Chemical Engineering Separations

The application of the fundamentals of chemistry, thermodynamics, mathematics, and transport phenomena to the design and evaluation of stage-wise and continuous contacting apparatus and systems for separating and purifying chemical materials. Steady-state and transient processes are studied.

Prerequisites: CHME 4010 and CHME 4020. Corequisite or prerequisite CHME 2020.

Fall term annually. *3 credit hours*

CHME 4050 Chemical Process Design

The design of equipment, processes, and systems of interest in chemical engineering through application of scientific, technological, and economic principles. The concepts of product design, design for the environment, and the ethical and safety issues of design are introduced. Emphasis is placed on problem formulation and the conceptual, analytical, and decision aspects of open-ended design situations. The work integrates knowledge and skills gained in previous and concurrent courses. This is a writing-intensive course.

Prerequisites: CHME 4040 and CHME 4500.

Spring term annually. *4 credit hours*

CHME 4150 Chemical Engineering Laboratory I

A two-term laboratory course on experimental analysis of the operations and processes of chemical engineering. Emphasis is placed on planning of experiments, data evaluation, and report writing. Prerequisites: CHME 4010, CHME 4020, and CHME 2020.

Fall and Spring terms annually. *3 credit hours*

CHME 4500 Chemical Reactor Design

Principles of kinetics, reactor design, and analysis for both homogeneous and heterogeneous (catalytic) systems. Topics include design for multiple reaction networks (optimum selectivity), analysis of simple reactor combinations, and design of isothermal, adiabatic, and optimum temperature profile reactor. Prerequisites: CHME 2010, CHME 4010 and CHME 4020.

Fall term annually. *3 credit hours*

BIOL 1010 Introduction to Biology

Introduction to biological systems. Discussion of problems associated with biological organization, scaling, and hierarchy. Major topics covered include evolution, genetics, molecular biology and biotechnology, and ecology. The course considers the biological components of various societal and individual problems. Taught in Web-based, interactive studio mode with emphasis on biological simulations, problem solving, and peer teaching methods. Includes a one-credit laboratory. Fall and Spring terms annually. *4 credit hours*

CHEM 1100 Chemistry I

Principles of chemistry, with particular focus on atomic and molecular structure and bonding, periodicity, basic thermodynamic principles, introduction to acid-base chemistry and elementary chemical equilibrium, and introduction to organic chemistry. Students cannot get credit for both this course and CHEM-1110.

Fall term annually. *4 credit hours*

CHEM 2250 Organic Chemistry I

Structure and chemical behavior of organic molecules with particular emphasis on reaction mechanisms as pathways for understanding their reactions. Stereochemistry, synthesis, and spectroscopic methods for the identification of organic functional groups are among the topics included. Prerequisite: CHEM 1200 or equivalent.

Fall term annually. *3 credit hours*

CHEM 2260 Organic Chemistry II

A continuation of CHEM 2250.

Prerequisite: CHEM 2250.

Spring term annually. *3 credit hours*

CHEM 4420 Microscopic Physical Chemistry

A course dealing primarily with physicochemical properties of substances on a molecular basis. Chemical kinetics, quantum chemistry, spectroscopy and statistical mechanics.

Prerequisite: CHEM 4410 or CHME 2020.

Spring term annually. *3 credit hours*

CHEM 4530 Modern Techniques in Chemistry

A lecture/laboratory course for Chemical Engineering students. Discusses the principles and applications of modern instrumental methods of chemical analysis and provides laboratory experience in their use along with other chemical techniques. Principles of analytical, organic, and physical chemistry will be illustrated throughout the course.

Prerequisite: CHEM 2250.

Fall and Spring terms annually. *4 credit hours*

PHYS 1100 Physics I

The first semester of a two-semester sequence of interactive courses. Topics include linear and angular kinematics and dynamics, work and energy, momentum and collisions, forces and fields, gravitation, elementary electrostatics, and motion of charged particles in a magnetic field.

Corequisite: MATH 1010 or equivalent or permission of instructor.

Fall term annually. *4 credit hours*

PHYS 1200 Physics II

The second semester of the two-semester sequence of interactive courses. Topics include Gauss's Law, current electricity, Ampere's Law and Faraday's Law, electromagnetic radiation, physical optics, and quantum physics.

Prerequisite: PHYS 1100 or equivalent or permission of instructor. Corequisite MATH 1020.

Spring term annually. *4 credit hours*

MATH 1010 Calculus I

Functions, limits, continuity, derivatives, implicit differentiation, related rates, maxima and minima, elementary transcendental functions, introduction to definite integral with applications to area and volumes of revolution.

Fall and Spring terms annually. *4 credit hours*

MATH 1020 Calculus II

Techniques and applications of integration, polar coordinates, parametric equations, infinite sequences and series, vector functions and curves in space, functions of several variables, and partial derivatives. Prerequisite: MATH 1010.

Fall and Spring terms annually. *4 credit hours*

MATH 2400 Introduction to Differential Equations

First-order differential equations, second-order linear equations, eigenvalues and eigenvectors of matrices, systems of first-order equations, stability and qualitative properties of nonlinear autonomous systems in the plane, Fourier series, separation of variables for partial differential equations. Prerequisite: MATH 1020 and some knowledge of matrices.

Fall and Spring terms annually. *4 credit hours*

CSCI 1190 Beginning C Programming for Engineers

This course will teach elementary programming concepts using the C language for engineering students with little or no prior programming experience. Students cannot get credit for this course and any other Computer Science course. Fall and Spring terms annually. *1 credit hour*

CHEMICAL AND BIOLOGICAL ENGINEERING CURRICULUM CHECKLIST Class of 2015

NAME: _____

E-mail: _____

Fall 2011				Spring 2012			
CHEM-1100	Chemistry I	4		BIOL-1010	Intro to Biology	4	
ENGR-1100	Intro. to Eng. Analysis	4		ENGR-1200	Eng Graphics and CAD ¹	1	
ENGR-1300	Engineering Processes ^{1,2}	1		MATH-1020	Calculus II	4	
MATH-1010	Calculus I	4		PHYS-1100	Physics I	4	
	Hum., Arts or Soc. Sci. El.	4			Hum., Arts or Soc. Sci. El.	4	
Fall 2012				Spring 2013			
CHEM-2250	Organic Chemistry I	3		CHEM-2260	Organic Chemistry II	3	
CHME-2010	Material, Energy, and Entropy Balances	4		CHME-2020	Energy, Entropy, and Equilibrium ³	3	
CSCI-1190	Beginning C Programming for Engineers	1		ENGR-2600	Modeling and Analysis of Uncertainty	3	
MATH-2400	Intro to Differential Equations	4			Free Elective	4	
PHYS-1200	Physics II	4			Hum., Arts or Soc. Sci. El.	4	
Fall 2013				Spring 2014			
CHEM-4530	Modern Techniques in Chemistry	4		CHEM-4420	Microscopic Physical Chemistry	3	
CHME-4010	Transport Phenomena I	4		CHME-4020	Transport Phenomena II	4	
CHME-4030	Chemical Process Dynamics and Control	4			Free Elective	4	
	Hum., Arts or Soc. Sci. El.	4			Hum., Arts or Soc. Sci. El.	4	
					Professional Development II ³	2	
Fall 2014				Spring 2015			
CHME-4040	Chemical Engineering Separations	3		CHME-4050	Chemical Process Design	4	
CHME-4150	Chemical Engineering Lab I	3		ENGR-4010	Professional Development III	1	
CHME-4500	Chemical Reactor Design	3			Lab Elective ⁴	3	
	Free Elective	4			Engineering Elective	4	
	Chemical Engineering Elective	3			Chemistry Elective	3	
Electives	<i>The chemistry elective must be in advanced chemistry or advanced chemistry-related subject.</i>						
	<i>The chemical engineering elective must be in chemical engineering or in an approved, advanced chem eng subject.</i>						
	<i>The engineering elective cannot be a chemical engineering course; it must be at least 2000-level and contain four credits of engineering topics.</i>						
Footnote¹	<i>These required courses may be taken in either order.</i>			Footnote²	<i>May be replaced by CHME.1010 Intro to Chemical Engineering</i>		
Footnote³	<i>Choice of STSS-4840 or PSYC-4170</i>			Footnote⁴	<i>Choice of SHME-4160 or CHME-4170</i>		

Registration

When: Registration for the Spring semester generally occurs in early November. Registration for the Fall semester occurs the preceding Spring, usually in early April. Exact dates are included in the [Academic Calendar](#).

How: Use the [Student Information System \(SIS\)](#) to register for your courses.

Where: There are no assigned rooms for registration. You can register for your classes using any computer with Internet access.

Time tickets

As a student here at Rensselaer, you are issued a "time ticket," which assigns you a specific window of time during which you may register for the next semester. Your time ticket will be sent to your RPI email address, 2 - 3 weeks before registration.

Your registration time is assigned based on the number of credit hours you have **earned** as a student. The table to the right shows the range of earned credit hours associated with each class. Please note that classes which are still in progress or courses which have been graded as "incomplete" do *not* count towards earned credits, nor do transferred courses and Advanced Placement (AP) credit.

School of Engineering

Freshman	0 - 30
Sophomore	31 - 60
Junior	61 - 95
Senior	96 - 128

You should receive your time ticket via e-mail approximately four weeks prior to the scheduled registration period. In addition to making the registration assignment, this e-mail message notifies you of any existing holds which may prevent you from registering if you do not resolve them.

CAPP reports

Your Curriculum Advising and Program Planning (CAPP) report is a planning and advising tool -- available only to undergraduate students -- that allows you to track the progress you're making toward your Bachelor's Degree. You can access your CAPP report via the main menu of the [Student Information System \(SIS\)](#).

Registration FAQs

What do I do if a class I want to register for is full?

Meet with the instructor of the course and request to be admitted to the course. If the class is a core/required course every effort will be made to accommodate the request. If this is an elective course you may be asked to take it in a subsequent semester.

How do I add/drop a course?

You may use the [Student Information System \(SIS\)](#) to add or drop courses. Generally speaking, from the beginning of the semester, you will have **two weeks to add** courses and **eight weeks to drop** them. Please refer to the Academic Calendar for specific add and drop deadline dates.

If you wish to petition to add or drop classes after the published deadline, you may do so using a [Late Add/Drop Form](#). Please note that after the instructor's signature (if required), the form must also be approved by the Advising and Learning Assistance Center.

Professional / Student Societies in the Dept. of CHBE

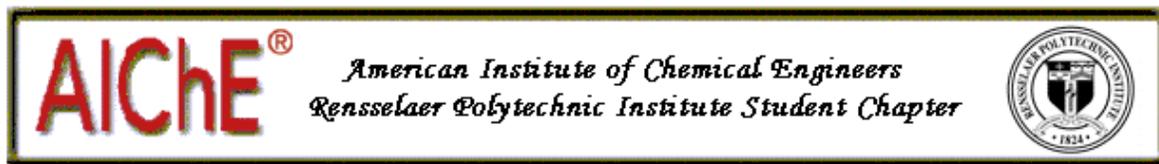
Omega Chi Epsilon – Faculty Advisor: Ravi Kane, CBIS 4105

RPI's chapter of Omega Chi Epsilon (OXE), the national chemical engineering honor society, has recognized excellent scholastic performance of junior, senior, and graduate chemical engineering students since 2004. The mission of our chapter extends beyond recognition of academic excellence; we also strive to benefit our department and our community. Our chapter is involved in a few community service activities, authoring an undergraduate handbook, hosting an annual graduate school symposium, and providing class registration advice. For more information, please visit our website at <http://omegachiepsilon.union.rpi.edu/> or email omegachiepsilon@union.rpi.edu.

Society of Biological Engineers – Faculty Advisor: Georges Belfort, CBIS 3209

SBE maintains student chapters to serve the intellectual and professional interests of students in the biological sciences. Through their individual and collective activities, the members of chapters are ambassadors for their chapter, for their biological engineering department, for their college/university, and for SBE. They are dedicated to the broader SBE mission to connect people, cultivating knowledge, and catalyze the future. Membership in SBE is now free to undergraduates. To join, fill out the [membership form](#).

American Institute of Chemical Engineering – Faculty Advisor: B. Wayne Bequette, RI 129



The American Institute of Chemical Engineers (AIChE) is a national organization with the mission to "promote excellence in the development and practice of chemical engineering." Its membership ranges from undergraduate students to professors, professional engineers to executive officers in major corporations.

RPI Membership Benefits:

- Here's your chance to meet and connect with the faculty and other CHME students!
- Get your resume out to the companies through our resume CD circulations.
- Food and refreshments are provided during our general body meetings.
- AIChE Events:
 - Plant Tours (from plastics to brewing beer)
 - Guest Speakers (from Chemical Engineering companies in the area)
 - General Body Meetings
 - Workshops
 - Bowling Nights/Movie Nights/Paintball/Laser Tag

Chapter Membership Fee: \$10

National Membership: This year AIChE national membership is free so we encourage everyone to join! It is a great way to network and take advantage of a large pool of resources, all for free. Sign up at <http://www.aiche.org/students>

Contact our treasurer Jake Tracy at tracyj@rpi.edu for more information.

Visit our website: <http://www.rpi.edu/dept/chem-eng/WWW/AICHE/>

Undergraduate Research Program (URP)

URP information website: <http://undergrad.rpi.edu/update.do?catcenterkey=77>

URP application: <http://undergrad.rpi.edu/update.do?artcenterkey=117>

Many of our undergraduate students collaborate with graduate students and faculty on undergraduate research projects (URP). Plus, many of our students participate in Rensselaer's Undergraduate Research Forum & Awards... and often win!

Faculty research activities span a wide range of topics in biotechnology, nanotechnology and advanced materials. Much of this research is interdisciplinary, involving collaborative efforts with faculty in chemistry, mathematics, biology, as well as biomedical and materials engineering. The breadth of chemical engineering allows us to speak many technical "languages" and interact with scientists and engineers from a variety of disciplines. Rensselaer has a very strong Undergraduate Research Program. This is a program that allows students to work in a professor's laboratory for credit, cash, or experience. On average, we have 30% of the class taking advantage of these opportunities during their Rensselaer career.

The program offers many advantages and the opportunity to:

- work on a project whose impact could be worldwide and can lead to patents and/or grants
- apply knowledge gained in the classroom to actual problems and research situations
- network with faculty beyond the classroom, opening the door to other opportunities
- gain critical leadership, team-building and critical thinking skills
- publish as an undergraduate
- receive course credit in a more dynamic way or supplement your income

How to find a project

Most URP projects are found through direct contact with the faculty member supervising the research. Most undergraduates find projects from faculty members from whom they have taken classes. A good place to start your search is to determine a faculty member with whom you may want to work on a project. Check their website to investigate their field of research. If it sounds interesting, approach them about a possible URP project.

What if I have my own idea for a project?

You may work with a faculty member on an existing research project or on a project based on your own ideas. If you want to pursue your own project, find a faculty advisor who may be interested in your topic since you will be required to have a project advisor.

For credit, funding or the experience?

You can earn from one to four credit hours per semester for your participation in the URP. The number of credit hours you earn is negotiable between you and your faculty sponsor. If you choose this option you and your sponsor need to:

- Determine how many credit hours you will earn
- Decide exactly what is expected of you, such as your time commitment, the type of work to be submitted, etc.
- Agree on how your grade will be determined

In the past, students who have participated in the URP for pay have earned up to \$3,000 per semester. The majority of participants earn \$400 per semester.

URP funding comes from two sources:

- Your sponsoring faculty member or department
- The Office of Undergraduate Education

The faculty sponsor or department is responsible for the financial support of your research. In addition, the Office of Undergraduate Education pays URP participants a maximum of \$400 per semester in the form of matching funds.

Most projects expect eight to twelve hours of work per week.

The URP application should be submitted to the Department Coordinator, Nancy Beatty; who:

- Checks the URP Application for completeness
- Fills out your payroll paperwork
- Forwards your application and payroll paperwork to the Office of Undergraduate Education for approval
- Will set up a schedule for reporting your hours. You must submit your hours to the Department Coordinator within the same payroll period that you worked. Please keep in mind that if you work and submit hours that exceed your funding allotment, you will not be paid for those hours. Pay checks are issued every other Friday

Applying for the Experience

No deadline specified. You would have the opportunity to apply to gain the experience of working on a research project.

Study Abroad – International Programs

The information on equivalent Chemical Engineering courses is found on the study abroad website. Otherwise, courses taken may sometimes be counted as a free elective, an engineering elective, a chemistry elective or in some cases substitute for an H&SS requirement. Please meet with your undergraduate advisor EARLY (Freshman year / Sophomore year) to plan ahead if you are interested in study abroad.

<http://undergrad.rpi.edu/update.do?catcenterkey=126>

Study Abroad Faq's

Is study abroad a requirement? Study abroad is currently not a formal requirement, but all students are strongly encouraged to take part in an international experience.

When can a student study abroad? Students generally go abroad during their junior year, although this is not a rule. You will need to consider your academic progress (i.e. what courses you have already taken, what you will take while abroad, and what you will need to take upon return) in order to remain on track and graduate on time.

Can I go abroad as a senior? Yes, but keep in mind that the primary recruiting season for employers is fall of the senior year. Make sure to inform the Career Development Center of your plans if you choose to study abroad as a senior.

When should I start planning my study abroad experience? Applications are generally due one semester in advance of your planned term abroad. Early planning is key to ensuring that you remain on track academically.

Can I get credit for any study abroad or international experience? Academic credit is granted for participation in RPI-affiliated exchange programs that take place during the academic year, or for faculty-led summer programs.

What if I want to study abroad on a non-affiliated study abroad program? During the academic year, you must take a leave of absence and no credit will be granted. During the summer months and the holiday break, students are encouraged to participate in international experiences, but no academic credit will be granted (with the exception of some RPI faculty-led summer programs).

What types of RPI-affiliated programs are currently available? Exchanges, architecture semester programs, short-term faculty led summer programs.

Does Rensselaer offer any international programs over the December-January semester break? No formal options are currently available, but the Office of International Programs is working to develop international opportunities for students to participate in during this period.

Am I guaranteed a space in the exchange program of my choice? No. Space is limited on most programs.

What is the application process for study abroad? Generally students complete an RPI Study Abroad Application and the required application of the host institution and submit an official transcript. Academic letters of recommendation and an essay are required for some programs.

Is a minimum GPA required? A 3.0 is generally required. Students who do not meet this requirement should discuss their plans with the appropriate study abroad administrator prior to completing an application.

What is the selection process for study abroad? All applications are reviewed by RPI faculty and study abroad staff. For most programs, an unofficial admissions decision is made at RPI, but official acceptances are always issued by the host institution.

Will my study abroad grades affect my Rensselaer GPA? No. Study abroad credits are effectively treated as transfer credits and are not factored into the GPA. The exceptions to this are the architecture programs which are taught by RPI faculty and treated as regular RPI courses.

What if I fail a course while on an exchange program? You must achieve the equivalent of a C- or better in order to receive RPI credit. If you fail a course it will not show up on your transcript, but no credit will be granted.

Do courses taken abroad show up on the RPI transcript? No, only credits earned will appear on your official transcript. Your unofficial transcript will show the RPI course equivalent.

How many credits/classes do I need to take while abroad? In order to maintain full-time status you must take the equivalent of 12 credits. The actual number of classes that you take will depend on the academic system of the host institution.

What classes may I take abroad? How do I find out what classes are available? This depends on the program. For most of the exchange programs, students select courses from among the regular course offerings at the host institution. For some programs, students select from a pre-approved list.

Do I need to have my course selections approved? YES! If you plan to participate in IMEP, GE³ or the Undergraduate Exchanges you must complete a Transfer Credit Approval Form and obtain the signature of the appropriate Transfer Credit Approval Evaluator from each academic department, as well as that of your academic advisor.

How do I register for study abroad classes? In most cases, this is done directly with the host institution following their registration procedures for exchange students.

What is my student status during my study abroad term? Students who participate in RPI-affiliated study abroad remain registered at RPI with full-time student status.

How much does it cost to study abroad? Students pay regular RPI tuition for participation in an RPI-affiliated study abroad experience and receive full RPI credit. Transportation and living expenses are the responsibility of the student, and in most cases are paid directly by the student.

Can I receive financial aid for study abroad? Yes, students who participate on RPI-affiliated study abroad programs receive their full financial aid package (with the exception of work study money), including any RPI scholarships.

Is housing guaranteed? This depends on the site, but in most cases, no. Each host institution provides students with housing information, and it is the responsibility of the student to apply.

What is a visa? Do I need one? Who will get this for me? A visa, or entry permit, is a stamp or attachment in your passport that allows you to enter a specific country for a certain period of time. A visa is issued by the country that requires it. It is the responsibility of the student to make sure that he or she

understands the visa requirements of the host country, to obtain the necessary application materials and supporting documents, and to apply according to the regulations of the host country. Common visa requirements include biometrics (fingerprinting) and an appointment at the Consulate of the host country (located in major U.S. cities).

What is REACH? Rensselaer Education Across Cultural Horizons, or REACH, is part of Rensselaer's initiative to provide all undergraduate students with an international experience. Initially launched in spring 2009 as an exchange program for engineering students, REACH has evolved to include all international opportunities for undergraduates, including semester-long study abroad and exchange opportunities, short-term and faculty-led international programs, and other international experiences such as internships and service learning. All students are encouraged and expected to take advantage of some sort of international experience during their four-year undergraduate education.

What is the Global Engineering Education Exchange Program (Global E³)? Global E³ is an international exchange program for engineering students at member institutions. The program is designed to allow students to take courses overseas for credit at their home institutions. Currently, exchanges mainly occur with western European universities plus selected individual institutions in other world regions, including Asia, central and eastern Europe, and Latin America.

How can I learn more? Study abroad information sessions will be conducted at the beginning of the fall and spring semesters. You can also contact the appropriate program administrator for more information:

[Karen Dvorak](#)

Program Manager
International Exchange Programs
& Faculty Led Summer Programs
Office of International Programs
Walker Lab; 4th floor
518-276-3411

[Jamie Obst](#)

Senior Program Administrator
DTU & NTU Exchanges; Global E³
Office of International Programs
Walker Lab; 4th floor
518-276-6663

[Beth Macey](#)

Senior Student Services Administrator, IMEP
Lally School of Management & Technology
Pittsburgh Building 3210
518-276-2388

[Carly Perruccio](#)

Administrative Specialist
International Programs
School of Architecture
Greene Building 115
518-276-6466

Co-Terminal B.S. / M.S. or M.E. Program

Juniors and first semester seniors who meet certain requirements can apply for [admission to the graduate program](#) and, by delaying completion of the B.S., can get continuing undergraduate support (student aid) for a fifth year. In this way, they can complete requirements for both the B.S. and M.S. degrees at the same time.

Student must:

- Please see Lee Vilardi (vilarl@rpi.edu) for minimum GPA and other requirements
- Have completed 90 credits of coursework (including AP credits, transfer credits, and courses in progress)

Upon admission to the program, students will be regarded as graduate students by the department but will not normally receive departmental support. They will not be required to take the placement exams. Students in this program who wish to transfer to the Ph.D. program must apply for it, and will be considered new applicants.

Co-Terminal FAQ's

Admission

1. **When do I apply?** Co-terminal applications must be submitted before the end of applicants' junior year. Applicants must have 90 credits (in progress or earned) of coursework towards their undergraduate degree (101 credits for Architecture students).
2. **Where do I find a Plan of Study?** The Plan of Study is available on-line at the Office of Graduate Education website [Plan of Study Form](#).
3. **What if the courses I list on the Plan of Study change?** If the courses listed change, an updated plan must be filed with your Department, the Office of Graduate Education, and the Office of the Registrar.

Financial Aid, Tuition and Fees

1. **Can I receive both Undergraduate Financial Aid and Graduate TA/RA aid?** No - If you receive a Graduate TA/RA you are no longer eligible for undergraduate financial aid or the co-terminal program.
2. **Do I have to file a FAFSA for my 5th year to get the Undergraduate aid?** Yes - you must file a FAFSA, if you receive need based aid
3. **I have a TA from my department. Do I need to notify anyone?** No - your department works with the Office of Graduate Education to ensure that your TA is processed appropriately. Once you accept a graduate TA, you are no longer eligible for undergraduate financial aid or the co-terminal program.

Academic

1. **When/how does a student get assigned a graduate adviser?** Co-terminal students will continue to work with their undergraduate adviser and should contact their department to be assigned a graduate advisor.
2. **How many credits will I be eligible to register for?** Since the primary degree you will be pursuing is your bachelor's degree, you will be eligible to register for up to 21 credits.

3. **Can I become a part-time student in the Co-Terminal Program?** Co-terminal student must remain as full time students and cannot shift to part-time status.
4. **Should I apply for my undergraduate degree if I will be registered into an 11th semester?** If you are continuing into an 11th semester, you will no longer be eligible for undergraduate aid. You should apply for your bachelor's degree at that point.
5. **When do I receive my BS degree? I was supposed to graduate in May 2010 but I will be completing 2 more semesters to receive my Master's degree under the co-terminal program?** You will receive both degrees at the end of your 10th semester. You should file a degree application with the Office of the registrar for each degree at the beginning of the semester in which you will actually graduate with both degrees. See the academic calendar for deadline information.
6. **Can I use a course for both my undergraduate and graduate degree?** No - credits applied toward satisfying requirements of the undergraduate degree cannot be used to satisfy the requirements for the master's degree.
7. **I finished my 9th semester but decided not to continue in the master's program. How do I receive my BS degree?** You must first, formally withdraw from the co-terminal program. This is done using the Graduate Student Request for Change of Status form. You must then file a Degree Application for the next graduation date. Rensselaer has three official graduation dates - the end of August, the end of December, and mid-May. Check the academic calendar for application submission deadlines.
8. **Can I still designate courses as Pass/No Credit?** Co-terminal students are subject to graduate degree program guidelines after they've earned the minimum number of credits required for their bachelor's degree (which will range from 124 to 128 depending on the School). Any courses taken after a student has reached the minimum, will be subject to graduate level policies, and graduate policies prohibit designating a graduate course as Pass/No Credit.
9. **Can I participate in the Commencement ceremony with my class?** You must meet the criteria for participation and file a petition, available in the Registrar's Office.

Co-terminal application: http://admissions.rpi.edu/graduate/Co-TerminalBS-MS_Application_and_Procedures.pdf

CHBE Faculty Research Interests

Chemical & Biological Engineering Current Research Interests 2011-12	Advanced Materials	Biochemical Engineering	Biomedical Engineering	Energy Sustainability	Fluid Mechanics	Interfacial Phenomena	Molecular Modeling & Simulations	Nanotechnology	Process Control, Design & Optimization	Separation & Bioseparation Processes
Georges Belfort	▪	▪	▪	▪	▪	▪		▪		▪
B. Wayne Bequette			▪	▪			▪		▪	
Cynthia Collins		▪	▪	▪					▪	
Marc-Olivier Coppens	▪			▪	▪	▪	▪	▪	▪	▪
Steven Cramer		▪	▪			▪	▪	▪		▪
Jonathan Dordick	▪	▪	▪	▪		▪		▪		
Shekhar Garde		▪				▪	▪	▪		
Ravi Kane	▪	▪	▪	▪	▪	▪		▪		▪
Pankaj Karande		▪	▪					▪		▪
Lealon Martin	▪	▪		▪	▪			▪	▪	
Joel Plawsky	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Peter Tessier		▪				▪		▪		▪
Patrick Underhill	▪			▪	▪		▪	▪		
Angel Garcia		▪				▪	▪	▪		
Amir Hirsra		▪			▪	▪				
Robert Linhardt	▪	▪	▪					▪		▪



Areas of Study/Degrees

Chemical Engineering,
MS, MEng, PhD

Typical Degree Requirements:
MS 30 credits (24 coursework, 6 thesis)
MEng 30 credits coursework
PhD 60 credits beyond MS + doctoral thesis (90 credits beyond BS)

Research Areas

We are actively pursuing research in a variety of multidisciplinary areas at the forefront of science and technology. Our research is externally funded by federal government and industry grants. Our research strengths are:

Advanced Materials
Biochemical Engineering
Biomedical Engineering
Fluid Mechanics
Drug Delivery
Interfacial Phenomena

Mass Transport
Molecular Simulations
Polymers
Process Control, Design, and Optimization
Separation and Bioseparation Processes
Thermodynamics

Research Centers

Biotechnology and Interdisciplinary Studies
Future Energy Systems
Nanotechnology
Computational Center for Nanotechnology Innovations (CCNI)
Center for Automation Technologies and Systems (CATS)
Fuel Cell and Hydrogen Research

Center for Integrated Electronics (CIE)
"Smart Lighting" Engineering Research Center
Center for Cheminformatics Research
Multiscale Science and Engineering
New York State Pollution Prevention Institute
Center for Biologically Functionally Organized Responsive Materials (BioFORM)

Admission

Submit on-line at: <http://gradadmissions.rpi.edu/>

Deadlines are January 1 for Summer and Fall admission and August 15 for Spring admission

You'll need: a well-written Statement of Background & Goals; official transcripts from all colleges attended; at least 2 letters of recommendation (preferably from faculty); official GRE scores (minimum 550 GRE Verbal, general test only), Undergraduate GPA 3.0 or above, and official TOEFL or IELTS scores (570 required for all international applicants); non-refundable application fee.

Financial Aid/Tuition

Most students receive financial aid.

Apply for financial aid through the admission application, *no separate form is required.*

Financial aid is available in the form of Fellowships, Teaching Assistantships, and Research Assistantships, that cover both tuition and stipend.

International students are eligible for all forms of aid except some fellowships that require US citizenship.

Awards are made based on merit with priority given to doctoral candidates.

Tuition for the 2010-2011 academic year is \$41,600; fees and insurance are approximately \$1,850; Living expenses, books and supplies can vary widely but are estimated at approximately \$11,000.

Contact Us

Lee Vilardi, Student Services Administrator, ChBE Student Services & Graduate Enrollment
Ricketts 130, 110 8th Street, Troy, New York 12180-3590
Phone: (518) - 276-6929 Fax: (518) - 276-4030
Email: vilarl@rpi.edu
<http://www.cbe.rpi.edu/>

Application to the Doctoral Program in Chemical Engineering

Most successful Doctoral Program applicants have a Bachelor's degree in Chemical Engineering. The deadline for Fall applications is the preceding January 1st. The deadline for Spring applications is the previous August 15th. All required materials and scores must be received by the deadline for the application to be complete and sent to the Doctoral Review Committee. Please send all supporting required materials in one envelope to Graduate Admissions.

GRE and TOEFL scores (for International applicants) must be sent directly from the testing organization to Institute code 2757. We require a minimum of 570 on the TOEFL and 550 on the GRE Verbal. We only require the GRE general test. The GRE scores are valid for 5 years from the date of the exam. The TOEFL scores are valid for 2 years from the date of the exam. We require a minimum of 3.0 GPA on a 4 point scale on the undergraduate degree program. You may send us the unofficial test scores to begin your application process, but your application will not be considered complete until the official scores arrive from the testing institute.

We have a limited number of financial aid awards reserved for our most outstanding PhD applicants who have submitted a complete application by the deadline. Most financial awards are given for Fall admission. Normally, no aid is available for master's degree candidates. Most successful doctoral applicants have a Bachelor's degree in Chemical Engineering, evidence of interest in research, such as published papers in scholarly journals or conference proceedings or undergraduate independent research with a faculty mentor. You do not need to contact any professors at the time of application.

We encourage you to visit the Graduate Admissions Web site at:
http://www.rpi.edu/dept/admissions/graduate/apply_now.html where you may apply directly on line.

Enrolling Students - Doctoral Program in Chemical Engineering

Upon your acceptance of our offer of admission, please be sure to update the CHBE Student Coordinator (Lee Vilardi, vilarl@rpi.edu) with an email address, mailing address and phone number where you may be reached over the summer. Keep this information up-to-date to receive important news and information throughout your affiliation with the department.

Most doctoral students are fully supported for the 4 – 5 years of study. You must always be registered in full-time status to receive financial aid and stipend pay. You will be given more information about this process in your award letter. Elaine Belokopitsky (beloke@rpi.edu) is the Business Administrator who will administer your financial pay.

You will be notified of the **department orientation** over the summer. The orientation is usually held the Wednesday prior to the first day of class.

New students are also required to attend an **Institute Orientation** program. All students who will be assigned as **first-time TAs** are **REQUIRED TO ATTEND THE MANDATORY TA TRAINING**. No exceptions may be made. Financial support is dependent upon completing the required training.

Doctoral students will be given many opportunities to explore which research area they would like to pursue. In mid-September, the new doctoral students will attend two evening sessions to hear presentations by the CHBE faculty. The faculty will briefly describe their current research interests. Students will then schedule individual appointments with at least six faculty members to further discuss topics of mutual interest. Students will be given a deadline to complete the appointments, and then will

turn in their top three choices. The faculty will also give their top choices. The process usually takes approximately two additional weeks to finalize a student/research advisor match, and then each student is notified of the decision by letter.

You should meet regularly with your research advisor. You should make a Graduate Plan of Study by November 1st of your first year, and then update the plan as necessary. The Graduate School and Registrar's office require a valid, signed, up-to-date plan be on file at all times.

In the spring of each term, doctoral students are required to meet with their advisor to complete the Doctoral Yearly Review. You will be sent an email when this is due to the Office of Graduate Education.

Your research advisor will guide you about doctoral requirements and Institute requirements, such as nomination of your doctoral committee, completion of your Candidacy and your Doctoral Defense.

Office of Graduate Education

<http://gradoffice.rpi.edu/setup.do>

1516 Peoples Avenue

(518) 276-2626

(518) 276-2256 fax

Registrar's Office

<http://srfs.rpi.edu/setup.do>

OPEN M-F 9am-4:30pm

2000 Level, Academy Hall

(518) 276-6231

(518) 276-6180 fax

Most forms you will need as a graduate student may be found at these Registrar and Grad Ed websites:

Grad Ed forms <http://gradoffice.rpi.edu/update.do?catcenterkey=20>

Registrar forms <http://srfs.rpi.edu/update.do?catcenterkey=29>

Frequently Asked Questions relating to the BS/Chemical Engineering degree:

- **Describe your curriculum.** The CHME curriculum builds on the engineering core, requiring an additional ½ year of advanced chemistry, and courses in process control, separations, chemical-reactor design, transport phenomena, advanced thermodynamics, and CHME laboratory and process design.
- **Minors?** Chemistry, Economics, Environmental Engineering, Biology and Management are popular options for minors.
- **Size of Graduating Class?** Currently, we have 299 undergraduate students: 60 seniors, 82 juniors, 71 sophomores and 86 freshmen.
- **Male/Female Ratio?** 36.1% female students. The Institute average is typically 25%.
- **How Many Faculty?** Currently, 14 tenure-track faculty, plus numerous affiliated RPI faculty. All have Ph.D's, and most have industrial and/or consulting experience.
- **Internship and Co-op Opportunities?** Ample. Over 25% of CHME seniors have participated in a summer internship experience or co-op. More students opt for an internship so as to stay on schedule for graduation. Co-ops are possible with careful planning early in your studies.
- **Undergraduate Research?** There are lots of opportunities. About 15% CHME seniors have participated in Rensselaer's Undergraduate Research Program. Most faculty have openings for research experiences for credit, and some have funding.
- **Graduate Program?** We have a strong graduate program, with about 65 full-time graduate students.
- **Eventual Employment Opportunities?** You name it: Chemicals, Petroleum, Personal Products, Biochemicals, Pharmaceuticals/Drug Delivery, Semiconductors, Aerospace, Utilities, Government/Military, Contractors/Consultants. The breadth of CHME education provides our graduates with a diversity of career options.