

# Chemical & Biomolecular Engineering (CHM ENG)

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## Courses

### CHM ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2022, Spring 2020, Spring 2019

The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.

#### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

#### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of seminar per week

#### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

### CHM ENG 40 Introduction to Chemical Engineering Design 2 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020

Design and analysis of processes involving chemical change. Strategies for design, such as creative thinking and (re)definition of the design goal. Methods for analyzing designs, such as mathematical modeling, empirical analysis by graphics, and dynamic scaling by dimensional analysis. Design choices in light of process efficiency, product quality, economics, safety, and environmental issues.

#### Rules & Requirements

**Prerequisites:** Math 1B OR Chem 4A

#### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 1.5 hours of discussion per week

#### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

### CHM ENG 84 Sophomore Seminar 1 or 2 Units

Terms offered: Spring 2013, Spring 2012, Spring 2010

Sophomore seminars are small interactive courses offered by faculty members in departments all across the campus. Sophomore seminars offer opportunity for close, regular intellectual contact between faculty members and students in the crucial second year. The topics vary from department to department and semester to semester. Enrollment limited to 15 sophomores.

#### Rules & Requirements

**Prerequisites:** At discretion of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

#### Hours & Format

##### Fall and/or spring:

5 weeks - 3-6 hours of seminar per week

10 weeks - 1.5-3 hours of seminar per week

15 weeks - 1-2 hours of seminar per week

##### Summer:

6 weeks - 2.5-5 hours of seminar per week

8 weeks - 2-4 hours of seminar per week

#### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

### CHM ENG 90 Science and Engineering of Sustainable Energy 3 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

An introduction is given to the science and technologies of producing electricity and transportation fuels from renewable energy resources (biomass, geothermal, solar, wind, and wave). Students will be introduced to quantitative calculations and comparisons of energy technologies together with the economic and political factors affecting the transition from nonrenewable to sustainable energy resources. Mass and energy balances are used to analyze the conversion of energy resources.

#### Rules & Requirements

**Prerequisites:** Chemistry 1A or 4A

#### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

#### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Bell, Segalman

## CHM ENG 98 Directed Group Studies for Lower Division Undergraduates 1 - 3 Units

Terms offered: Spring 2025, Fall 2024, Spring 2023

Supervised research on a specific topic.

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Credit Restrictions:** Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-3 hours of directed group study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

## CHM ENG 98W Directed Group Study 1 Unit

Terms offered: Fall 2015

Directed group study consisting of supplementary problem sets, review sessions, and discussions related to chemical engineering. Topics vary with instructor.

### Rules & Requirements

**Prerequisites:** This Chemical Engineering 98W is planned for students who are concurrently enrolled in Chemical Engineering 140

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

## CHM ENG 101 Chemical Business Fundamentals I 4 Units

Terms offered: Prior to 2007

This upper division course for science and engineering students is the first of a two-course series that covers the business fundamentals for technology professionals. This course is only offered as part of a four-course summer minor program in Responsible Process Implementation within the Department of Chemical & Biomolecular Engineering. Through the use of applicable cases and examples from the chemical and process industries, students will learn the basic concept of business and the role that technology professionals are expected to play in a business environment.

### Hours & Format

**Summer:** 6 weeks - 10 hours of lecture and 3 hours of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

## CHM ENG 102 Chemical Business Fundamentals II 4 Units

Terms offered: Prior to 2007

This upper division course for science and engineering students is the continuation of a two-course series that covers the business fundamentals for technology professionals. This course is only offered as part of a four-course summer minor program in Responsible Process Implementation within the Department of Chemical & Biomolecular Engineering. It is intended to introduce the marketing, product development, and operational aspects of a business enterprise, to help technology professionals optimize their effectiveness when performing their duties within a multifunctional organization, and to illuminate the effects of their actions and decisions on the performance of a business entity.

### Rules & Requirements

**Prerequisites:** CHMENG S101

### Hours & Format

**Summer:** 6 weeks - 10 hours of lecture and 3 hours of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

## CHM ENG 103 New Process Implementation: Concept to Commercialization 3 Units

Terms offered: Prior to 2007

This upper division course for science and engineering students is to be taken in the second 6-week summer session of the summer minor program in Responsible Process Implementation within the Department of Chemical & Biomolecular Engineering. Students will use all of the materials presented in this program to address process design and control challenges. Specifically, they will learn how to make process design and control decisions that satisfy all of the technical requirements and optimize the economic benefits while addressing the ethical, environmental, and social impact.

### Rules & Requirements

**Prerequisites:** CHM ENG 101 & CHM 101

### Hours & Format

**Summer:** 6 weeks - 10 hours of lecture and 3 hours of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

## CHM ENG 104 Ethics and Professional Social Responsibility 1 Unit

Terms offered: Prior to 2007

This upper division course for science and engineering students covers the concept of environmental ethics and responsibility in the chemical industry. This course is only offered as part of a summer minor program in Responsible Process Implementation by the Chemical and Biomolecular Engineering. It is intended to impress upon the importance of professional social responsibilities of engineering decision making. Topics of discussion include corporate citizenship, business and stakeholder relationship, environmental responsibilities, engineering and technology ethics and other key aspects of engineering professional social responsibilities such as social justice, health, safety and welfare of stakeholders.

### Rules & Requirements

**Prerequisites:** CHM ENG 101

### Hours & Format

**Summer:** 6 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

## CHM ENG 130 Mathematics and Statistics in Chemical Engineering 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

The purpose of this course is to teach students the analytical, numerical, and statistical methods required for setting up and solving mathematical problems, with emphasis on CBE applications. Methods for solving algebraic equations, initial value problems, boundary value problems, and partial differential equations, as well as probability theory, will be covered. Programming tools such as Python and Matlab will be used in this course. This is not a programming course. The majority of the learning will be through the active use of these programs by the students in solving assigned problems.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 140 Introduction to Chemical Process Analysis 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Material and energy balances applied to chemical process systems. Determination of thermodynamic properties needed for such calculations. Sources of data. Calculation procedures.

### Rules & Requirements

**Prerequisites:** Chemistry 4B (may be taken concurrently) or Chemistry 1B; and Physics 7B (may be taken concurrently)

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 141 Chemical Engineering Thermodynamics 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

Thermodynamic behavior of pure substances and mixtures. Properties of solutions, phase equilibria. Thermodynamic cycles. Chemical equilibria for homogeneous and heterogeneous systems.

### Rules & Requirements

**Prerequisites:** 140 with a grade of C- or higher; Engineering 7, which may be taken concurrently

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 142 Chemical Kinetics and Reaction Engineering 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Analysis and prediction of rates of chemical conversion in flow and nonflow processes involving homogeneous and heterogeneous systems.

### Rules & Requirements

**Prerequisites:** 141 with a grade of C- or higher; 150B, which may be taken concurrently

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 143 Computational Methods in Chemical Engineering 4 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022

The purpose of Chemical Engineering Modeling and Computations in Chemical Engineering is to teach students the methodologies used in setting up mathematical models of simple chemical processes and operations, and the numerical techniques used to simulate them. Included are techniques to obtain physical properties of mixtures/ solutions using equations of state. This is followed by simple processes such as vapor liquid equilibrium, separation operations such as distillation, heat transfer, and chemical reactions in ideal reactors such as stirred tank and plug flow. Later on, real chemical process equipment and processes are modeled and simulated, using many of the techniques learned earlier. Programming languages such as Matlab and...

### Objectives & Outcomes

**Course Objectives:** The focus of this course is on developing insights into chemical processes and operations through the use of modeling and computations. This is not a programming course. The instructors will provide introduction to the use of Aspen and the other codes, but the majority of the learning will be through the active use of these programs by the students in solving assigned problems.

**Student Learning Outcomes:** The course will be consistent with the overall objectives of the Chemical Engineering curriculum as outlined in the ABET guidelines.

### Rules & Requirements

**Prerequisites:** E7 and CHM ENG 140

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

## CHM ENG 148 Principles and applications of colloids and interfaces 3 Units

Terms offered: Spring 2025

Interfacial and colloid science deals with the behavior & properties of particles, films, and other systems with large surface to volume ratios. The large interfacial area gives rise to the properties associated with nanotechnology. It is a field that draws from physical chemistry, materials science, and thermodynamics. An objective of the course is to develop your fundamental understanding that will guide your intuition and to help you develop quantitative descriptions applicable to a wide range of problems. Covered are how properties of surfaces, interfaces, and nanoscale features differ from bulk materials. We will discuss fundamental interfacial physics and chemistry, as well as touching on state-of-the-art technologies.

### Objectives & Outcomes

**Course Objectives:** Derive relationships and the formalism to describe the physical manifestations observed in colloidal systems, nanostructured materials, micro/nanoscale devices.

Develop quantitative relationships between the molecular world and macroscopic observations.

Gain a basic understanding of how molecular interactions lead to interfacial phenomena and colloidal behavior.

**Student Learning Outcomes:** An awareness of contemporary issues which have an impact on the discipline of CBE (xi)

The lectures and problems are based on recent high impact published work or significant technological issues in colloids and interfacial science. The reading material is also based on ongoing important fundamental challenges in interfacial science. The formalism developed in class is put in context of a bigger picture and students are asked to discuss the impact of the work presented within the discipline. For each topic covered the state of the art, the limit of current knowledge, as well as ongoing challenges in the field are discussed in class.

Knowledge of emerging applied science within CBE, attained through electives and/or research (vii)

As an advanced undergraduate course, material is introduced at the textbook level but is quickly translated to emerging applications and innovations through discussion and presentations of the recent research literature.

The ability to apply the fundamentals of chemistry, biology, mathematics and physics to CBE practice (i)

An emphasis is placed on problem solving (homework, and exams) that requires students to apply the principles of chemistry and physics, especially in developing physically meaningful constitutive relationships to describe colloids and interfacial phenomena. Mathematical analysis, derivations, and problem solving strategies are used extensively throughout the course.

The ability to design, conduct, and evaluate experiments, including the analysis and interpretation of data (iv)

A component of the problem sets and questions in exams include giving raw experimental data (with noise and errors) that needs to be analyzed using the formalism developed in the course. The students also discuss experimental results and data presented in recent scientific literature.

The ability to use the techniques, skills, and engineering tools for modern engineering practice (v).

Students routinely need to use numerical methods (python, excel, or matlab) to solve equations, organize data, and plot their results.

## CHM ENG 150A Transport Processes 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

Principles of fluid mechanics and heat transfer with application to chemical processes. Laminar and turbulent flow in pipes and around submerged objects. Flow measurement. Heat conduction and convection; heat transfer coefficients.

### Rules & Requirements

**Prerequisites:** 140 with a grade of C- or higher; Math 54, which may be taken concurrently

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 150B Transport and Separation Processes 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Principles of mass transfer with application to chemical processes. Diffusion and convection. Simultaneous heat and mass transfer; mass transfer coefficients. Design of staged and continuous separations processes.

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 141 with a grade of C- or higher; Chemical and Biomolecular Engineering 150A with a grade of C- or higher; Engineering 7

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

**Summer:** 8 weeks - 6 hours of lecture and 2 hours of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 154 Chemical Engineering Laboratory 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024

Experiments in physical measurements, fluid mechanics, heat and mass transfer, kinetics, and separation processes. Emphasis on investigation of basic relationships important in engineering. Experimental design, analysis of results, and preparation of engineering reports are stressed.

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 141, 142, and 150B

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 8 hours of laboratory per week

**Summer:** 8 weeks - 2 hours of lecture and 16 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 160 Chemical Process Design 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024

Design principles of chemical process equipment. Design of integrated chemical processes with emphasis upon economic considerations.

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 142, 150B, and 154. 154 can be taken concurrently

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

**Summer:** 8 weeks - 6 hours of lecture and 6 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 161S Industrial Chemical Process Design 6 Units

Terms offered: Prior to 2007

Design of chemical processes and equipment, with an emphasis on industry-sponsored and/or industry-tailored processes

### Objectives & Outcomes

**Course Objectives:** Teach students the strategies used in the design of chemical processes through an authentic industrial project.

**Student Learning Outcomes:**

- Develop an ability to function on multi-disciplinary teams.

- Develop the ability to design an integrated chemical engineering-based process to meet stated objectives within realistic constraints.

- Establish proficiency in the design process and project management fundamentals.

- Gain an understanding of professional and ethical responsibilities.

### Rules & Requirements

**Prerequisites:** Prerequisites: Chemical and Biomolecular Engineering 142, 150B, and 154

### Hours & Format

**Summer:** 8 weeks - 6 hours of lecture and 6 hours of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Bryan, Sciamanna

## CHM ENG 162 Dynamics and Control of Chemical Processes 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024

Analysis of the dynamic behavior of chemical processes and methods and theory of their control. Implementation of computer control systems on process simulations.

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 142 and 150B; Mathematics 53 and 54

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.



## CHM ENG 170A Biochemical Engineering 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170A, the first of a two-semester sequence will be on the upstream bioprocess of how to make products by designing unit operations and processes around living systems of cells.

### Rules & Requirements

**Prerequisites:** BIO ENG 11 or MCB 102 (or equivalent) highly recommended. Chem Eng 150B and Chem Eng 142 or concurrent, or consent of instructor(s)

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Zhang, Ryder

## CHM ENG 170B Biochemical Engineering 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170B, the second of a two-semester sequence will be on the downstream bioprocess of recovery, separations and purification of bio-based products.

### Rules & Requirements

**Prerequisites:** BIO ENG 11 or MCB 102 (or equivalent) highly recommended. Chem Eng 150B and Chem Eng 142 or concurrent, or consent of instructor(s)

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Zhang, Ryder

**Formerly known as:** 170

## CHM ENG C170L Biochemical Engineering Laboratory 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024, Fall 2018, Spring 2014, Spring 2013

Laboratory techniques for the cultivation of microorganisms in batch and continuous reactions. Enzymatic conversion processes. Recovery of biological products.

### Rules & Requirements

**Prerequisites:** Chemical Engineering 170A (may be taken concurrently) or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 7 hours of laboratory and 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** CHEM C170L

### **CHM ENG 171 Transport Phenomena 3 Units**

Terms offered: Spring 2021, Fall 2018, Spring 2011

Study of momentum, energy, and mass transfer in laminar and turbulent flow.

#### **Rules & Requirements**

**Prerequisites:** 150B

#### **Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### **Additional Details**

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

### **CHM ENG 176 Principles of Electrochemical Processes 3 Units**

Terms offered: Spring 2025, Spring 2024, Spring 2022

Principles and application of electrochemical equilibria, kinetics, and transport processes. Technical electrolysis and electrochemical energy conversion.

#### **Rules & Requirements**

**Prerequisites:** Chemical and Biomolecular Engineering 141, 142, and 150B

#### **Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### **Additional Details**

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

### **CHM ENG C178 Polymer Science and Technology 3 Units**

Terms offered: Fall 2025, Spring 2025, Spring 2023, Fall 2016, Spring 2016, Spring 2015

An interdisciplinary course on the synthesis, characterization, and properties of polymer materials. Emphasis on the molecular origin of properties of polymeric materials and technological applications. Topics include single molecule properties, polymer mixtures and solutions, melts, glasses, elastomers, and crystals. Experiments in polymer synthesis, characterization, and physical properties.

#### **Rules & Requirements**

**Prerequisites:** Junior standing

#### **Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### **Additional Details**

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** CHEM C178

### **CHM ENG 179 Process Technology of Solid-State Materials Devices 3 Units**

Terms offered: Fall 2025, Spring 2024, Spring 2023

Chemical processing and properties of solid-state materials. Crystal growth and purification. Thin film technology. Application of chemical processing to the manufacture of semiconductors and solid-state devices.

#### **Rules & Requirements**

**Prerequisites:** Engineering 45; one course in electronic circuits recommended; senior standing

#### **Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### **Additional Details**

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.



## CHM ENG 180 Chemical Engineering Economics 3 Units

Terms offered: Fall 2023, Fall 2022, Fall 2020

Optimal design of chemical processes and unit operations, emphasizing the interactions between technical and economic considerations. Analysis of process risks. Chemical and biomolecular process design in the presence of uncertainties. Interest rate determinants and their effects on chemical process feasibility and choices. Relationships between structure and behavior of firms in the chemical processing industries. Multivariable input-output analyses.

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 142 and 150B. Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 182 Nanoscience and Engineering Biotechnology 3 Units

Terms offered: Fall 2022, Fall 2021, Spring 2020

This nanoscale science and biomolecular engineering course will cover emerging topics in applied biotechnology and nanotechnology. Topics include enzyme kinetics, enzyme inhibition, recombinant protein generation, cell culture, genome editing, drug design, nanoparticle-based gene and drug delivery, fluorescence imaging, and sensors. The course will also probe the interface of biology with nanomaterials, and standard microscopic techniques to image biological structures and nanoscale materials.

### Rules & Requirements

**Prerequisites:** Bio 1A or BioE 11 and Physics 7A

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

**Instructor:** Landry

## CHM ENG 183 Climate Solutions Technologies 3 Units

Terms offered: Fall 2020

This course for upper division students in science and engineering disciplines covers energy and climate and specific technologies that can be implemented to reduce global warming. Topics include renewable energy (wind and solar), carbon management technologies including Carbon Capture, Utilization and Storage, and Negative Emissions Technologies. The technologies will be described and compared from an upper level chemical engineering perspective that includes fundamental concepts in thermodynamics and separations. We will also cover carbon economics and policies and life-cycle analysis. The course will be framed from a systems-thinking perspective. Throughout the course we will focus on key aspects of communicating climate science.

### Objectives & Outcomes

**Course Objectives:** After taking this course, students should be able to discuss and explain to peers the role of CO<sub>2</sub> in the earth's climate, the greenhouse effect, the carbon cycle and how it relates to the fate of greenhouse gases on many time scales, and the role of fossil fuel combustion in the energy landscape and in CO<sub>2</sub> emissions. Students in this class will gain experience in applying principles of systems thinking, engineering design and analysis to specific technologies that are relevant for mitigating climate change in the immediate future.

Students will appreciate the critical role that communication plays in the path to implementation of solutions and will be comfortable engaging in a discussion about climate solutions with technical and non-technical peers.

Students will gain a basic understanding of economics relative to climate policies, and of climate solutions currently being discussed by policymakers; they will gain an understanding of how these individual solutions fit into a global scheme.

Students will gain knowledge about the most current technologies available for producing energy renewably, managing carbon, and reducing atmospheric greenhouse gas concentrations.

### Rules & Requirements

**Prerequisites:** Chem 1A,B or 4A,B, Phys 7A,B, Math 1A,B

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Instructor:** Went

## CHM ENG 186 Fundamental Electrochemistry 3 Units

Terms offered: Summer 2025 First 6 Week Session

Electrochemistry is a field of science that describes the interrelation of chemical and electrical effects. Much of the field deals with describing how chemical changes are caused by the passage of electrical current or how the production of electrical current can be caused by chemical reactions. Electrochemists rely on a foundational understanding of chemical thermodynamics and electrostatics, chemical and electron-transfer kinetics, and mass-transport phenomena – each of which are treated and developed in this course in the context of electrochemical phenomena. Additional topics include electrochemical instrumentation, practical electrochemistry, and electrochemical impedance spectroscopy.

### Rules & Requirements

**Prerequisites:** Undergraduates in CHMENG 186 are generally expected to have completed junior-level courses in their major. CBE majors must have taken CHMENG 142, CHMENG 150B, or CHEM 120A

### Hours & Format

**Summer:** 6 weeks - 6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 187 Electrochemical Device Engineering 3 Units

Terms offered: Summer 2025 Second 6 Week Session

Electrochemical engineering combines the study of charge transfer at electrode/electrolyte interfaces with the development of practical materials and processes. Electrochemical devices/reactors, their voltage and current distribution, mass-transport, hydrodynamics, geometry, and overall performance in terms of reaction yield, conversion efficiency, and energy efficiency are examined. Electrochemical energy storage (batteries and capacitors), energy conversion (low- and high-temperature fuel cells and electrolyzers), and metal plating and electrosynthesis devices are covered. Fundamental chemistry, physics, and engineering principles that govern device response are emphasized.

### Rules & Requirements

**Prerequisites:** CHMENG 186/286 Advanced Electrochemistry Fundamentals

### Hours & Format

**Summer:** 6 weeks - 6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG 188 Electrochemical Projects Laboratory 3 Units

Terms offered: Summer 2025 Second 6 Week Session

Students work in teams to solve open-ended research and development projects in electrochemical science, engineering, and technology. The projects for the course come from industry partners, national laboratory partners, and academic research laboratories. This allows the students to develop skills solving unstructured problems representative of what they will face in their career. Example projects span electrolysis and fuel cells, interfacial electrochemistry, batteries, and electrosynthesis.

### Rules & Requirements

**Prerequisites:** CHEMENG 186/286 Electrochemistry Fundamentals

### Hours & Format

**Summer:** 6 weeks - 16 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG H193 Senior Honors Thesis 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

A senior honors thesis is written in consultation with the student's faculty research advisor. This is a required course for students wishing to graduate with honors in Chemical Engineering.

### Rules & Requirements

**Prerequisites:** Senior standing, approval of faculty research advisor, overall GPA of 3.4 or higher

### Hours & Format

**Fall and/or spring:** 15 weeks - 9 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

## CHM ENG H194 Research for Advanced Undergraduates 2 - 4 Units

Terms offered: Fall 2025, Spring 2024, Fall 2023

Original research under direction of one of the members of the staff.

### Rules & Requirements

**Prerequisites:** Minimum GPA of 3.4 overall at Berkeley and consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

## CHM ENG 195 Special Topics 2 - 4 Units

Terms offered: Spring 2021, Spring 2020, Fall 2019

Lectures and/or tutorial instruction on special topics. Please refer to the Notes section in the Academic Guide for the current course description.

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

## CHM ENG C195A The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013

After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be placed on the integration of the biological aspects (crop selection, harvesting, storage and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-the-art research.

### Rules & Requirements

**Prerequisites:** Chemistry 1B or Chemistry 4B, Mathematics 1B, Biology 1A

**Repeat rules:** Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Bell, Blanch, Clark, Smit, C. Somerville

**Also listed as:** BIO ENG C181/CHEM C138/PLANTBI C124

## CHM ENG 196 Special Laboratory Study 2 - 4 Units

Terms offered: Fall 2023, Summer 2023 8 Week Session, Summer 2022 8 Week Session

Special laboratory or computational work under direction of one of the members of the staff.

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-3 hours of independent study per week

### Summer:

6 weeks - 5-8 hours of independent study per week

8 weeks - 3.5-6 hours of independent study per week

10 weeks - 3-4.5 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

## CHM ENG 197 Field Study in Chemical Engineering 1 - 4 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

Supervised experience in off-campus organizations relevant to specific aspects and applications of chemical engineering. Written report required at the end of the term. Course does not satisfy unit or residence requirements for the bachelor's degree.

### Rules & Requirements

**Prerequisites:** Upper division standing and consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-4 hours of fieldwork per week

### Summer:

6 weeks - 2.5-10 hours of fieldwork per week

8 weeks - 1.5-7.5 hours of fieldwork per week

10 weeks - 1.5-6 hours of fieldwork per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Instructor:** Strauss

## CHM ENG 198 Directed Group Study for Undergraduates 1 - 3 Units

Terms offered: Spring 2024, Spring 2023, Fall 2022

Supervised research on a specific topic. Enrollment is restricted; see Introduction to Courses and Curricula section in the General Catalog.

### Rules & Requirements

**Prerequisites:** Completion of 60 units of undergraduate study and in good academic standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-3 hours of lecture per week

**Summer:** 6 weeks - 2.5-7.5 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

## CHM ENG 199 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-4 hours of independent study per week

### Summer:

6 weeks - 2.5-10 hours of independent study per week

8 weeks - 1.5-7.5 hours of independent study per week

10 weeks - 1.5-6 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

## CHM ENG 230 Mathematical Methods in Chemical Engineering 3 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022

The course aims to introduce a variety of mathematical and computational methods useful in solving research problems pertaining to chemical and biomolecular systems. The course covers a wide range of topics from linear algebra and matrices, differential equations, and stochastic methods. Even though the focus is primarily on analytical methods, most of the concepts will be demonstrated with computations and applications. The goal of the course is to ensure that the students are aware of a wide range of computational methods that can be useful in their research and to provide the students with sufficient background in applied mathematics that can be useful in reading the science and engineering literature.

### Rules & Requirements

**Prerequisites:** Math 53 and 54 or equivalent; open to seniors with consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 236 Physics-Inspired Machine Learning 3 Units

Terms offered: Spring 2025, Spring 2024

Machine learning in the context of scientific problems is an exciting emerging area of research, and often requires the development of new methods that can incorporate and exploit the inductive biases and structure needed for such problems. There are also now numerous examples of concepts in physics historically influencing machine learning methods development more broadly. This course will give an overview of different physics-inspired machine learning methods, and the connections between concepts in physics (numerical methods, dynamical systems, symmetries, conservation laws) and machine learning.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 240 Thermodynamics for Chemical Product and Process Design 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Topics covered include molecular thermodynamics of pure substances and mixtures, interfacial thermodynamics, statistical mechanics, and computer simulations.

### Rules & Requirements

**Prerequisites:** Math 53 and 54 or equivalent; 141 or equivalent; open to seniors with consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 244 Kinetics and Reaction Engineering 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Molecular processes in chemical systems, kinetics and catalysis. Interaction of mass and heat transfer in chemical processes. Performance of systems with chemical reactors.

### Rules & Requirements

**Prerequisites:** 142 or equivalent; open to seniors with consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 245 Catalysis 3 Units

Terms offered: Spring 2025, Fall 2020, Spring 2019

Adsorption and kinetics of surface reactions; catalyst preparation and characterization; poisoning, selectivity, and empirical activity patterns in catalysis; surface chemistry, catalytic mechanisms and modern experimental techniques in catalytic research; descriptive examples of industrial catalytic systems.

### Rules & Requirements

**Prerequisites:** 244 or Chemistry 223, or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 246 Principles of Electrochemical Engineering 3 Units

Terms offered: Spring 2012, Fall 2010, Fall 2009

Electrode processes in electrolysis and in galvanic cells. Charge and mass transfer in ionic media. Criteria of scale-up.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 248 Applied Surface and Colloid Chemistry 3 Units

Terms offered: Spring 2025, Spring 2023, Spring 2020

Principles of surface and colloid chemistry with current applications; surface thermodynamics, wetting, adsorption from solution, disperse systems, association colloids, interacting electrical double layers and colloid stability, kinetics of coagulation, and electrokinetics.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 250 Transport Processes 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

Basic differential relations of mass, momentum, and energy including creeping, laminar, and turbulent flow, boundary layers, convective-diffusion in heat and mass transfer, and simultaneous multicomponent mass and energy transport. Analytic mathematical solution of the equations of change using classical techniques including: separation of variables, similarity solutions, and Laplace and Fourier transforms.

### Rules & Requirements

**Prerequisites:** Chemical & Biomolecular Engineering 150A, 150B; Mathematics 53 and 54, or equivalent; open to seniors with consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 256 Advanced Transport Phenomena 3 Units

Terms offered: Spring 2024, Fall 2020, Fall 2018

Formulation and rigorous analysis of the laws governing the transport of momentum, heat, and mass, with special emphasis on chemical engineering applications. Detailed investigation of laminar flows complemented by treatments of turbulent flow systems and hydrodynamic stability.

### Rules & Requirements

**Prerequisites:** 230

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG C268 Physicochemical Hydrodynamics 3 Units

Terms offered: Spring 2017, Fall 2013, Fall 2011, Spring 2011

An introduction to the hydrodynamics of capillarity and wetting. Balance laws and short-range forces. Dimensionless numbers, scaling and lubrication approximation. Rayleigh instability. Marangoni effect. The moving contact line. Wetting and short-range forces. The dynamic contact angle. Dewetting. Coating flows. Effect of surfactants and electric fields. Wetting of rough or porous surfaces. Contact angles for evaporating systems.

### Rules & Requirements

**Prerequisites:** A first graduate course in fluid mechanics such as 260A-260B

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Morris

**Also listed as:** MEC ENG C268

## CHM ENG C270 Protein Engineering 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2010

An in-depth study of the current methods used to design and engineer proteins. Emphasis on how strategies can be applied in the laboratory. Relevant case studies presented to illustrate method variations and applications. Intended for graduate students.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Tullman-Ercek

**Also listed as:** BIO ENG C219



## CHM ENG 274 Biomolecular Engineering 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

Fundamentals in biomolecular engineering. Structures, dynamics, and functions of biomolecules. Molecular tools in biotechnology. Metabolic and signaling networks in cellular engineering. Synthetic biology and biomedical engineering applications.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 275 Advanced Bioprocess Engineering 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

This course is designed for students interested in obtaining advanced training in bioprocess engineering for applications in the biopharmaceutical, industrial biotech, and food tech industries. Emphasis will be placed on integrated application of quality by design (QbD) framework, good manufacturing practice (GMP), statistical experimental design, and other advanced concepts addressing current industry needs.

### Rules & Requirements

**Prerequisites:** CHMENG 170A, CHMENG 170B concurrent (or consent of instructor)

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 275L Advanced Bioprocess Engineering Laboratory 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

This pilot-scale laboratory course is designed for students interested in obtaining advanced training in bioprocess engineering for applications in the biopharmaceutical, industrial biotech, and food tech industries. Featured equipment (and experiments) include: Sartorius ambr250 (design of experiments), ABEC 300L bioreactor (fermentation), Alfa Laval disc stack centrifuge (liquid-solid separation), Alfa Laval M20 filtration skid (tangential flow filtration), and GE ÄKTA Avant chromatography unit (protein purification).

### Rules & Requirements

**Prerequisites:** CHMENG 170A, CHMENG C170L, CHMENG 170B concurrent (or consent of instructor)

### Hours & Format

**Fall and/or spring:** 15 weeks - 8 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 286 Fundamental Electrochemistry 3 Units

Terms offered: Summer 2025 First 6 Week Session

Electrochemistry is a field of science that describes the interrelation of chemical and electrical effects. Much of the field deals with describing how chemical changes are caused by the passage of electrical current or how the production of electrical current can be caused by chemical reactions. Electrochemists rely on a foundational understanding of chemical thermodynamics and electrostatics, chemical and electron-transfer kinetics, and mass-transport phenomena – each of which are treated and developed in this course in the context of electrochemical phenomena. Additional topics include electrochemical instrumentation, practical electrochemistry, and electrochemical impedance spectroscopy.

### Rules & Requirements

**Prerequisites:** Graduate students in Chemistry, Engineering or Physics disciplines should be suitably prepared to enroll in CHMENG 286 but are recommended to review preparatory materials posted on the Center for Electrochemical Science, Engineering, and Technology website: <https://electrochemistry.berkeley.edu/education>

### Hours & Format

**Summer:** 6 weeks - 6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 287 Electrochemical Device Engineering 3 Units

Terms offered: Summer 2025 Second 6 Week Session

Electrochemical engineering combines the study of charge transfer at electrode/electrolyte interfaces with the development of practical materials and processes. Electrochemical devices/reactors, their voltage and current distribution, mass-transport, hydrodynamics, geometry, and overall performance in terms of reaction yield, conversion efficiency, and energy efficiency are examined. Electrochemical energy storage (batteries and capacitors), energy conversion (low- and high-temperature fuel cells and electrolyzers), and metal plating and electrosynthesis devices are covered. Fundamental chemistry, physics, and engineering principles that govern device response are emphasized.

### Rules & Requirements

**Prerequisites:** CHMENG 186/286 Advanced Electrochemistry Fundamentals

### Hours & Format

**Summer:** 6 weeks - 6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 288 Electrochemical Projects Laboratory 3 Units

Terms offered: Summer 2025 Second 6 Week Session

Students work in teams to solve open-ended research and development projects in electrochemical science, engineering, and technology. The projects for the course come from industry partners, national laboratory partners, and academic research laboratories. This allows the students to develop skills solving unstructured problems representative of what they will face in their career. Example projects span electrolysis and fuel cells, interfacial electrochemistry, batteries, and electrosynthesis.

### Rules & Requirements

**Prerequisites:** CHEMENG 186/286 Electrochemistry Fundamentals

### Hours & Format

**Summer:** 6 weeks - 16 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 293C Curricular Practical Training Internship 0.0 Units

Terms offered: Prior to 2007

This is an independent study course for international students doing internships under the Curricular Practical Training program.

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Summer:** 8 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG C294A Mechanics and Physics of Lipid Bilayers 3 Units

Terms offered: Fall 2017

Lipid bilayers constitute the membrane that encloses every animal cell and many of its interior structures, including the nuclear envelope, the organelles and the endoplasmic reticulum. This is a unique course devoted to modern developments in this exceptionally active field of research, ranging from models based on continuum theory to recent developments based on statistical mechanics.

### Objectives & Outcomes

**Student Learning Outcomes:** To expose students to advanced current work on the mechanics and physics of lipid bilayers (a very active field of current research relevant to biomechanics and biophysics)

### Rules & Requirements

**Prerequisites:** Mechanical Engineering 185 or equivalent

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Steigmann

**Also listed as:** MEC ENG C285E

## CHM ENG 295B Special Topics in Chemical Engineering: Electrochemical, Hydrodynamic, and Interfacial Phenomena 2 Units

Terms offered: Fall 2011, Spring 2011, Fall 2010

Current and advanced study in chemical engineering, primarily for advanced graduate students.

### Rules & Requirements

**Prerequisites:** Open to properly qualified graduate students

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG C295A The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013

After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be places on the integration of the biological aspects (crop selection, harvesting, storage, and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-art research.

### Rules & Requirements

**Prerequisites:** Biology 1A; Chemistry 1B or 4B, Mathematics 1B

**Repeat rules:** Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Bell, Blanch, Clark, Smit, C. Somerville

**Also listed as:** BIO ENG C281/CHEM C238/PLANTBI C224

## CHM ENG C295L Implications and Applications of Synthetic Biology 3 Units

Terms offered: Spring 2007

Explore strategies for maximizing the economic and societal benefits of synthetic biology and minimizing the risks; create "seedlings" for future research projects in synthetic biology at UC Berkeley; increase multidisciplinary collaborations at UC Berkeley on synthetic biology; and introduce students to a wide perspective of SB projects and innovators as well as policy, legal, and ethical experts.

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Arkin, Keasling

**Also listed as:** BIO ENG C230

## CHM ENG C295R Applied Spectroscopy 3 Units

Terms offered: Fall 2023, Spring 2009, Spring 2007, Spring 2002

After a brief review of quantum mechanics and semi-classical theories for the interaction of radiation with matter, this course will survey the various spectroscopies associated with the electromagnetic spectrum, from gamma rays to radio waves. Special emphasis is placed on application to research problems in applied and engineering sciences. Graduate researchers interested in systematic in situ process characterization, analysis, or discovery are best served by this course.

### Rules & Requirements

**Prerequisites:** Graduate standing in engineering, physics, chemistry, or chemical engineering; courses: quantum mechanics, linear vector space theory

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Reimer

**Also listed as:** AST C295R

## CHM ENG C295Z Energy Solutions: Carbon Capture and Sequestration 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2015, Spring 2014, Spring 2013

After a brief overview of the chemistry of carbon dioxide in the land, ocean, and atmosphere, the course will survey the capture and sequestration of CO<sub>2</sub> from anthropogenic sources. Emphasis will be placed on the integration of materials synthesis and unit operation design, including the chemistry and engineering aspects of sequestration. The course primarily addresses scientific and engineering challenges and aims to engage students in state-of-the-art research in global energy challenges.

### Rules & Requirements

**Prerequisites:** Chemistry 4B or 1B, Mathematics 1B, and Physics 7B, or equivalents

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Bourg, DePaolo, Long, Reimer, Smit

**Also listed as:** CHEM C236/EPS C295Z

## CHM ENG 295K Design of Functional Interfaces 3 Units

Terms offered: Spring 2011, Spring 2005, Fall 2004

This course introduces students to the concepts and techniques involved in the design and physical characterization of advanced functional materials consisting of well-defined interfaces. Throughout the course, principles of supramolecular chemistry on solid surfaces are applied to functional systems. Materials with different connectivity and structure at the active site are compared for development of understanding. Specific topics include catalysis, separations, encapsulation, and biomedicine.

### Rules & Requirements

**Prerequisites:** Graduate standing

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Katz

## CHM ENG 295N Polymer Physics 3 Units

Terms offered: Spring 2015, Spring 2010, Spring 2008

This course, which is based on Gert Strobl's book addresses the origin of some of the important physical properties of polymer liquids and solids. This includes phase transitions, crystallization, morphology of multiphase polymer systems, mechanical properties, response to mechanical and electric fields, and fracture. When possible, we will develop quantitative molecular models that predict macroscopic behavior. The course will address experimental data obtained by microscopy, light and neutron scattering, rheology, and dielectric relaxation.

### Rules & Requirements

**Prerequisites:** 230 and 240

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 295P Special Topics in Chemical Engineering: Introduction to New Product Development 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

This course is part of the product development initiative sponsored by the department of chemical engineering. It focuses on real-life practices and challenges of translating scientific discovery into commercial products. Its scope is limited in most circumstances to situations where some knowledge of chemical engineering, chemistry, and related disciplines might prove to be particularly useful. The course primarily uses case studies of real-world new product development situations to simulate the managerial and technical challenges that will confront students in the field. We will cover a wide range of topics including basic financial, strategic and intellectual property concepts for products, managing risk and uncertainty, the effective new product development team, the evolving role of corporate R&D, the new venture product company and the ethics of post-launch product management.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Alexander

## CHM ENG 295Q Special Topics in Chemical Engineering: Advanced Topics in New Product Development 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023

This course is a part of the product development initiative sponsored by the department of chemical engineering. The course builds on the coverage in 295P of real-life practices of translating scientific discovery into commercial products. We will cover a wide range of advanced product development concepts including technology road maps, decision analysis, six sigma, product portfolio optimization, and best practices for field project management.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor. 295P recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Alexander

## CHM ENG 295S Special Topics in Chemical Engineering: Introduction to Experimental Surface Chemistry 3 Units

Terms offered: Fall 2015, Fall 2014, Spring 2011

This course is intended to introduce chemical engineering students to the concepts and techniques involved in the study of chemical processes at surfaces. Special emphasis will be placed on the chemistry of semiconductor surfaces. Topics to be covered include thermodynamics and kinetics of surfaces; crystal and electronic structures of clean surfaces (metals and semiconductors); adsorption and desorption; surface kinetics and dynamics including diffusion; dynamics of growth and etching; surface reaction models; a survey of modern surface analytical techniques including electron diffraction, auger electron spectroscopy, photoelectron spectroscopy, vibrational spectroscopy, scanning tunneling microscopy, and mass spectrometry.

### Rules & Requirements

**Prerequisites:** 240 or equivalent

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

## CHM ENG 295T Hard-Technology Innovation: Proof-of-Commercial Value Method 3 Units

Terms offered: Prior to 2007

This course is part of the Product Development Program initiative sponsored by the Department of Chemical and Biomolecular Engineering. The course builds on the coverage in Chemical Engineering 295P of real-life practices of translating scientific discovery into commercial products. In this course, we will cover a new risk-reduction methodology for bringing to market complex technical inventions that initially have a high risk profile that discourages investment for commercialization. The central learning objective in this course is: How might we utilize a new approach that would enable university-affiliated hard-tech innovators to sufficiently de-risk their venture propositions so that they become "fundable" by investors?

### Rules & Requirements

**Prerequisites:** Instructor approval needed

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Alexander, Joshi, Sciamanna

## CHM ENG 296 Special Study for Graduate Students in Chemical Engineering 1 - 6 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

Special laboratory and theoretical studies.

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** The grading option will be decided by the instructor when the class is offered.

## CHM ENG 298 Seminar in Chemical Engineering 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023

Lectures, reports, and discussions on current research in chemical engineering. Sections are operated independently and directed toward different topics.

### Rules & Requirements

**Prerequisites:** Open to properly qualified graduate students with consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of seminar per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG 298B Seminar in Bioprocess Engineering 1 Unit

Terms offered: Fall 2025, Spring 2025, Fall 2024

Weekly seminar with industry partners invited to give presentations on bio-based research, technologies, equipment, processes, and/or products. Provides an interactive interface for students and the bioprocess industry. Offered Fall and Spring semesters.

### Rules & Requirements

**Prerequisites:** CBE 170A and CBE 170B (can be taken concurrently)

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5 hours of seminar per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG 298C Colloquium in Chemical Engineering 1 - 2 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024

Lectures, reports, and discussions on current research in chemical engineering.

### Rules & Requirements

**Prerequisites:** Open to properly qualified graduate students with consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-3 hours of colloquium per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG 299 Research in Chemical Engineering 1 - 12 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024

Research.

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-12 hours of independent study per week

### Summer:

6 weeks - 2.5-30 hours of independent study per week

8 weeks - 1.5-22.5 hours of independent study per week

10 weeks - 1.5-18 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate

**Grading:** Letter grade.



## CHM ENG 300 Professional Preparation: Supervised Teaching of Chemical Engineering 2 Units

Terms offered: Spring 2020, Spring 2019, Spring 2016

Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.

### Rules & Requirements

**Prerequisites:** Graduate standing, appointment as a Graduate Student Instructor, or consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG 375 Professional Preparation: Supervised Teaching of Chemical Engineering 2 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.

### Rules & Requirements

**Prerequisites:** Graduate standing, appointment as a Graduate Student Instructor, or consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/  
Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

## CHM ENG 602 Individual Studies for Graduate Students 1 - 8 Units

Terms offered: Fall 2019, Spring 2019, Fall 2018

Individual study in consultation with the major field adviser for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D.

### Rules & Requirements

**Prerequisites:** Graduate standing in Ph.D. program

**Credit Restrictions:** Course does not satisfy unit or residence requirements for doctoral degree.

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Chemical & Biomolecular Engineering/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.