Chemical and Biomolecular Engineering

At Berkeley, graduate work in chemical and biomolecular engineering emphasizes the excitement of original research in frontier areas of applied science. Graduate students may pursue a PhD in Chemical Engineering, or they may apply to either the Product Development or Bioprocess Engineering concentration to obtain an MS in Chemical Engineering. While formal courses are necessary to provide scientific fundamentals and intellectual breadth, the primary characteristic of Berkeley's graduate experience is to participate in the quest for new knowledge. Graduate students and faculty collaborate as partners in scholarship, in learning, and in intellectual discovery.

Master's Concentrations

Product Development Program (MS)

The PDP is a graduate-level degree program whose central aim is to fill the unmet need at national and international levels for graduates of chemical engineering and related disciplines who have knowledge and field experience in the complex process of transforming technical innovations into commercially successful products. In the space of one calendar year, PDP graduates will gain exposure to real-world product development practices in a range of chemical process-intensive industries including biotechnology, microelectronics, nanoscience, and consumer products (concentrations within the program). The PDP does not require a research thesis, but students will find completing the extensive coursework and field study assignment challenging. By combining elements of advanced technical knowledge with focused business-related training, the PDP aims to fill a specific niche in the “choice space” of graduate education options for engineering graduates.

The academic content of the program is the result of a careful design process using as input the results of extensive interviews with industry, faculty and students. Each component of the program has been thoroughly vetted with several representatives from each one of these stakeholder groups. As currently structured, the program will offer a one calendar year course of study that will result in the award of a Master’s of Science Degree in Chemical Engineering with an emphasis in product development.

Bioprocess Engineering (MS)

The Master of Science in Chemical Engineering with a concentration in Bioprocess Engineering (MSCEBE) will provide you upon completion of a 9-month program with an understanding and ability to apply Bioprocess Engineering to a number of key technological needs spanning multiple industries. These include ways to produce biofuels, pharmaceuticals, and other high-value biologics; how to design and/or operate appropriate unit operations (e.g., fermentation systems), mammalian-cell culture systems, and instrumentation to monitor and control biotechnological processes; and how to apply and test bioproduct separation technologies. Unlike other programs, the new program at UC Berkeley will have access to state-of-the-art bioprocessing equipment at the Advanced Biofuels Process Demonstration Unit (ABPDU), which is part of the Lawrence Berkeley National Laboratory. Access to the ABPDU will afford you with an integrated didactic experience. As a result, you will be able to immediately apply hands-on knowledge and become specialized in knowing how to relate engineering concepts to biological system sand organisms.

PhD Program

The PhD program is designed to enlarge the body of knowledge of the student and, more importantly, to discover and develop talent for original, productive, and creative work in chemical and biomolecular engineering. Breadth of knowledge and professional training are achieved through advanced course work. To develop the creative talents of the student, a paramount emphasis in the PhD program is placed on intensive research, a project on which students work closely with one or more members of the faculty.

PhD students may choose to add a designated emphasis (DE) to their program. A designated emphasis is a specialization, such as a new method of inquiry or an important field of application, which is relevant to two or more existing doctoral degree programs. Designated emphases open to students in this PhD program include: Nanoscale Science and Engineering (NSE); Energy Sciences and Technology (DEEST); Communication, Computation and Statistic; Computational and Genomic Biology; and New Media.

Admission to the University

Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor’s degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and
4. Sufficient undergraduate training to do graduate work in the given field.

Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master’s or professional master’s degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master’s degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master’s degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master’s degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted,* then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted,* an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries or political entities in which the official language is not English are required to submit official evidence of English language proficiency. This applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:
   - courses in English as a Second Language,
   - courses conducted in a language other than English,
   - courses that will be completed after the application is submitted, and
   - courses of a non-academic nature.

   If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

Where to Apply

Visit the Berkeley Graduate Division application page (http://grad.berkeley.edu/admissions/apply) .

Admission to the Program

Admission is granted by the University's Graduate Division on the recommendation of the department. Applicants generally are required to provide the following: evidence of superior performance in the last two years of undergraduate studies; test scores for the aptitude portion of the Graduate Record Examination (the advanced GRE or subject test is not required); and three letters of recommendation from professors or colleagues familiar with the applicant's academic and professional aptitudes. International students whose native language is not English must provide evidence of English language proficiency. The weight of evidence from all sources determines admission. Students do not need a master's degree to apply for a doctoral degree. Most applicants will have completed a typical undergraduate program in chemical engineering. However, admission may be granted to students with undergraduate degrees in a related discipline. In this case, necessary background courses in chemical engineering are taken as part of the program for the first year.

Curriculum

A total of 18 units of letter-graded courses must be taken during residence in the graduate program. In the first semester a minimum of 9 units must be obtained from the core chemical engineering courses in the areas of mathematics, thermodynamics, reaction engineering, and transport phenomena. In addition students are required to take the CHM ENG 375 pedagogy course and two semesters in CHM ENG 300. Students should be registered full time with a minimum of 12 units.

9 units: Chemical Engineering graduate core courses		
CHM ENG 230	Mathematical Methods in Chemical Engineering	3
CHM ENG 240	Thermodynamics for Chemical Product and Process Design	3
CHM ENG 244	Kinetics and Reaction Engineering	3
CHM ENG 245	Catalysis	3
CHM ENG 250	Transport Processes	3
CHM ENG 274	Biomolecular Engineering	3
9-12 units: Graduate or upper division electives		

Product Development Concentration

The Master's PDP program places equal emphasis on advanced course work in new product development principles, specific industry practices, and the field study assignment. Successful completion of each of these elements is a prerequisite to graduation. The specific courses taken in the PDP program are selected in consultations between the student, the PDP executive director, and a faculty adviser. Upon entrance to the program, students will be required to declare an industry area specialization so that an appropriate academic schedule can be constructed. Students must complete a minimum of 28 units with at least 18 of those units from letter-graded courses which include a minimum of 12 units in graduate-level (i.e., 200 series) courses.

Specific coursework to pursue an industry track will vary based on the individual student's interests and the availability of course offerings in a given year.

For examples of representative curricula for each industry track, please visit:

http://chemistry.berkeley.edu/grad/cbe/pdp/graduation-requirements

Bioprocess Engineering Concentration (available for 2017-18)

The Master of Science in Chemical Engineering with a concentration in Bioprocess Engineering (MSCEBE) will provide you upon completion of a 9-month program with an understanding and ability to apply Bioprocess Engineering to a number of key technological needs spanning multiple industries. These include ways to produce biofuels, pharmaceuticals,

and other high-value biologics; how to design and/or operate appropriate unit operations (e.g., fermentation systems), mammalian-cell culture systems, and instrumentation to monitor and control biotechnological processes; and how to apply and test bioproduct separation technologies. Unlike other programs, the new program at UC Berkeley will have access to state-of-the-art bioprocessing equipment at the Advanced Biofuels Process Demonstration Unit (ABPDU), which is part of the Lawrence Berkeley National Laboratory. Access to the ABPDU will afford you with an integrated didactic experience. As a result, you will be able to immediately apply hands-on knowledge and become specialized in knowing how to relate engineering concepts to biological system sand organisms.

Chemical and Biomolecular Engineering

CHM ENG 230 Mathematical Methods in Chemical Engineering 3 Units

Terms offered: Fall 2017, Fall 2014, Fall 2010
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.
Mathematical Methods in Chemical Engineering: Read More [+]
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.

Mathematical Methods in Chemical Engineering: Read Less [-]

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

Terms offered: Fall 2017, Fall 2016, Fall 2015
Topics covered include molecular thermodynamics of pure substances and mixtures, interfacial thermodynamics, statistical mechanics, and computer simulations.
Thermodynamics for Chemical Product and Process Design: Read More [+]
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.

Thermodynamics for Chemical Product and Process Design: Read Less [-]

CHM ENG 244 Kinetics and Reaction Engineering 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015
Molecular processes in chemical systems, kinetics and catalysis. Interaction of mass and heat transfer in chemical processes. Performance of systems with chemical reactors.
Kinetics and Reaction Engineering: Read More [+]
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.

Kinetics and Reaction Engineering: Read Less [-]

CHM ENG 245 Catalysis 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015
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.
Catalysis: Read More [+]
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.

Catalysis: Read Less [-]

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.
Principles of Electrochemical Engineering: Read More [+]
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.

Principles of Electrochemical Engineering: Read Less [-]

CHM ENG 248 Applied Surface and Colloid Chemistry 3 Units

Terms offered: Spring 2014, Spring 2012, Spring 2010
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.
Applied Surface and Colloid Chemistry: Read More [+]
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.

Applied Surface and Colloid Chemistry: Read Less [-]

CHM ENG 250 Transport Processes 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Transport Processes: Read More [+]
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.

Transport Processes: Read Less [-]

CHM ENG 256 Advanced Transport Phenomena 3 Units

Terms offered: Fall 2016, Spring 2009
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.
Advanced Transport Phenomena: Read More [+]
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.

Advanced Transport Phenomena: Read Less [-]

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.
Physicochemical Hydrodynamics: Read More [+]
Rules & Requirements

Prerequisites: A first graduate course in fluid mechanics sucs 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

Physicochemical Hydrodynamics: Read Less [-]

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.
Protein Engineering: Read More [+]
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

Protein Engineering: Read Less [-]

CHM ENG 274 Biomolecular Engineering 3 Units

Terms offered: Spring 2018, Fall 2015, Fall 2014
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.
Biomolecular Engineering: Read More [+]
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.

Biomolecular Engineering: Read Less [-]

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.
Mechanics and Physics of Lipid Bilayers: Read More [+]
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

Mechanics and Physics of Lipid Bilayers: Read Less [-]

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.
Special Topics in Chemical Engineering: Electrochemical, Hydrodynamic, and Interfacial Phenomena: Read More [+]
Rules & Requirements

Prerequisites: Open to properly qualified graduate students

Repeat rules: Course may be repeated for credit.

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.

Special Topics in Chemical Engineering: Electrochemical, Hydrodynamic, and Interfacial Phenomena: Read Less [-]

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.
Design of Functional Interfaces: Read More [+]
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

Design of Functional Interfaces: Read Less [-]

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.
Polymer Physics: Read More [+]
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.

Polymer Physics: Read Less [-]

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

Terms offered: Fall 2016, Fall 2015, Fall 2014
This course is part of the product development initative 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 uncertainity, 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.
Special Topics in Chemical Engineering: Introduction to New Product Development: Read More [+]

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

Special Topics in Chemical Engineering: Introduction to New Product Development: Read Less [-]

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

Terms offered: Spring 2018, Spring 2016, Spring 2015
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.
Special Topics in Chemical Engineering: Advanced Topics in New Product Development: Read More [+]

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

Special Topics in Chemical Engineering: Advanced Topics in New Product Development: Read Less [-]

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.
The Berkeley Lectures on Energy: Energy from Biomass: Read More [+]

Rules & Requirements

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

Repeat rules: 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

The Berkeley Lectures on Energy: Energy from Biomass: Read Less [-]

CHM ENG C295L Implications and Applications of Synthetic Biology 3 Units

Terms offered: Prior to 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.,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.

Implications and Applications of Synthetic Biology: Read More [+]

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

Implications and Applications of Synthetic Biology: Read Less [-]

CHM ENG C295L Implications and Applications of Synthetic Biology 3 Units

Terms offered: Prior to 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.,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.

Implications and Applications of Synthetic Biology: Read More [+]

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

Implications and Applications of Synthetic Biology: Read Less [-]

CHM ENG C295R Applied Spectroscopy 3 Units

Terms offered: 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.
Applied Spectroscopy: Read More [+]
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

Applied Spectroscopy: Read Less [-]

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

Terms offered: 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 CO2 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.
Energy Solutions: Carbon Capture and Sequestration: Read More [+]
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

Energy Solutions: Carbon Capture and Sequestration: Read Less [-]

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.
Special Study for Graduate Students in Chemical Engineering: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit.

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.

Special Study for Graduate Students in Chemical Engineering: Read Less [-]

CHM ENG 298 Seminar in Chemical Engineering 1 Unit

Terms offered: Spring 2016, Fall 2015, Spring 2015
Lectures, reports, and discussions on current research in chemical engineering. Sections are operated independently and directed toward different topics.
Seminar in Chemical Engineering: Read More [+]
Rules & Requirements

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

Repeat rules: Course may be repeated for credit.

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.

Seminar in Chemical Engineering: Read Less [-]

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

Terms offered: Spring 2018, Fall 2017, Spring 2017
Lectures, reports, and discussions on current research in chemical engineering.
Colloquium in Chemical Engineering: Read More [+]
Rules & Requirements

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

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.

Colloquium in Chemical Engineering: Read Less [-]

CHM ENG 299 Research in Chemical Engineering 1 - 12 Units

Terms offered: Spring 2018, Fall 2017, Summer 2016 8 Week Session
Research.
Research in Chemical Engineering: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit.

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.

Research in Chemical Engineering: Read Less [-]

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

Terms offered: Spring 2016, Fall 2015, Spring 2015
Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.
Professional Preparation: Supervised Teaching of Chemical Engineering: Read More [+]
Rules & Requirements

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

Repeat rules: Course may be repeated for credit.

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.

Professional Preparation: Supervised Teaching of Chemical Engineering: Read Less [-]

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

Terms offered: Fall 2015, Fall 2014, Spring 2014
Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.
Professional Preparation: Supervised Teaching of Chemical Engineering: Read More [+]
Rules & Requirements

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

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.

Professional Preparation: Supervised Teaching of Chemical Engineering: Read Less [-]

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

Terms offered: Spring 2016, Fall 2015, Spring 2015
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.
Individual Studies for Graduate Students: Read More [+]
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.

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.

Individual Studies for Graduate Students: Read Less [-]