

# Chemical Engineering/ Nuclear Engineering Joint Major

## Bachelor of Science (BS)

The joint major programs are designed for students who wish to undertake study in two areas of engineering in order to qualify for employment in either field or for positions in which competence in two fields is required. The joint majors contain comparable proportions of coursework in both major fields. While they require slightly increased course loads, they can be completed in four years. Both majors are shown on the student's transcript of record. Students in this joint major program are concurrently enrolled in both the College of Engineering and the College of Chemistry, but their college of residence will be the College of Chemistry.

The areas of nuclear technology that depend heavily upon chemical engineering training include isotope separation, fuel reprocessing, waste management, feed material preparation, fuel chemistry, effluent control, fusion reactor fuel processing, and new reactor types.

## Admission to the Joint Major

Admission to the joint major programs is open to transfer students but closed to freshmen. Continuing students may petition for a change to a joint major program after their first year. For further details regarding how to declare the joint major, please contact the College of Chemistry.

## Other Joint Major Offered with the College of Engineering

Chemical Engineering/Materials Science Engineering (<http://guide.berkeley.edu/archive/2017-18/undergraduate/degree-programs/chemical-engineering-materials-science-joint-major>)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

## General Guidelines

1. A minimum grade point average (GPA) of 2.0 must be maintained in all courses undertaken at UC Berkeley, including those from UC Summer Sessions, UC Education Abroad Program, UC Berkeley in Washington Program, and XB courses from University Extension.
2. A minimum GPA of 2.0 in all courses taken in the college is required in order to advance and continue in the upper division.
3. A minimum GPA of 2.0 in all upper division courses taken at the University is required to satisfy major requirements.
4. Students in the College of Chemistry who receive a grade of D+ or lower in a chemical and biomolecular engineering or chemistry course for which a grade of C- or higher is required must repeat the course at UC Berkeley.

For information regarding grade requirements in specific courses, please see the notes sections below.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

## Lower Division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 1A & 1AL or CHEM 4A	General Chemistry and General Chemistry Laboratory General Chemistry and Quantitative Analysis	4
CHEM 1B or CHEM 4B	General Chemistry General Chemistry and Quantitative Analysis	4
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
MAT SCI 45	Properties of Materials	3
MAT SCI 45L	Properties of Materials Laboratory	1

## Upper Division Requirements

CHEM 120A or PHYSICS 137A	Physical Chemistry Quantum Mechanics	3-4
CHM ENG 140	Introduction to Chemical Process Analysis	4
CHM ENG 141	Chemical Engineering Thermodynamics	4
CHM ENG 142	Chemical Kinetics and Reaction Engineering	4
CHM ENG 150A	Transport Processes	4
CHM ENG 150B	Transport and Separation Processes	4
CHM ENG 154	Chemical Engineering Laboratory	4
CHM ENG 160	Chemical Process Design	4
or NUC ENG 170	Nuclear Design: Design in Nuclear Power Technology and Instrumentation	
CHM ENG 162	Dynamics and Control of Chemical Processes	4
ENGIN 117	Methods of Engineering Analysis	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 104	Radiation Detection and Nuclear Instrumentation Laboratory	4
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 162	Radiation Biophysics and Dosimetry	3
or BIOLOGY 1A	General Biology Lecture	
Nuclear engineering electives: select 6 units of upper division NUC ENG courses		
Engineering electives: select 3-4 units of upper division engineering courses.		

Undergraduate students in the College of Chemistry must fulfill the following requirements in addition to those required by the major program.

For detailed lists of courses that fulfill college requirements, please see the College of Chemistry (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/chemistry/#collegerequirementstext>) page in this Guide.

## Entry Level Writing

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the

Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

## American History and American Institutions

The American History and Institutions requirements are based on the principle that a US resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

## American Cultures

American Cultures is the one requirement that all undergraduate students at Cal need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

## Foreign Language

**Applies to Chemistry and Chemical Biology majors only.**

The Foreign Language requirement may be satisfied with one foreign language, in one of the following ways:

- By completing in high school the third year of one foreign language with minimum grades of C-.
- By completing at Berkeley the second semester of a sequence of courses in one foreign language, or the equivalent at another institution. Only foreign language courses that include reading and composition as well as conversation are accepted in satisfaction of this requirement. Foreign language courses may be taken on a Pass/No Pass basis.
- By demonstrating equivalent knowledge of a foreign language through examination, including a College Entrance Examination Board (CEEB) Advanced Placement Examination with a score of 3 or higher (if taken before admission to college), an SAT II: Subject Test with a score of 590 or higher, or a proficiency examination offered by some departments at Berkeley or at another campus of the University of California.

## Reading and Composition

In order to provide a solid foundation in reading, writing and critical thinking the College requires lower division work in composition.

- Chemical Engineering majors – A-level R&C course (e.g., English R1A) by end of freshman year
- Chemical Biology and Chemistry majors – A- and B-level courses by end of sophomore year

## Humanities and Social Sciences Breadth Requirement – Chemistry & Chemical Biology majors

- 15 units total; includes Reading & Composition (R1A + R1B) and American Cultures courses

- Remaining units must come from the College of Chemistry's lists of approved humanities and social science courses
- Breadth courses may be taken on a Pass/No Pass basis (excluding R&C)
- AP, IB, and GCE A-level exam credit may be used to satisfy the breadth requirement

## Humanities and Social Sciences Breadth Requirement – Chemical Engineering major

- 22 units total; includes Reading & Composition (R1A only) and American Cultures courses
- Breadth Series requirement: As part of the 22 units, students must complete two courses, at least one being upper division, in the same or very closely allied humanities or social science department(s). AP credit may be used to satisfy the lower division aspect of the requirement.
- Breadth Series courses and all remaining units must come from the College of Chemistry's lists of approved humanities and social science courses
- Breadth courses may be taken on a Pass/No Pass basis (excluding R&C)
- AP, IB, and GCE A-level exam credit may be used to satisfy the breadth requirement

## Class Schedule Requirements

Minimum units per semester – 13

Maximum units per semester – 19.5

12 units of course work each semester must satisfy degree requirements.

Chemical engineering freshmen and Chemistry majors are required to enroll in a minimum of one chemistry course each semester.

After the freshman year, Chemical Engineering majors must enroll in a minimum of one chemical and biomolecular engineering course each semester.

## Semester Limit

- Students who entered as freshmen – 8 semesters
- Chemistry & Chemical Biology majors who entered as transfer students – 4 semesters
- Chemical Engineering and Joint majors who entered as transfer students – 5 semesters

Summer sessions are excluded when determining the limit on semesters. Students who wish to delay graduation to complete a minor, a double major, or simultaneous degrees must request approval for delay of graduation before what would normally be their final two semesters. The College of Chemistry does not have a rule regarding maximum units that a student can accumulate.

## Senior Residence

After 90 units toward the bachelor's degree have been completed, at least 24 of the remaining units must be completed in residence in the

College of Chemistry, in at least two semesters (the semester in which the 90 units are exceeded, plus at least one additional semester).

To count as a semester of residence for this requirement, a program must include at least 4 units of successfully completed courses. A summer session can be credited as a semester in residence if this minimum unit requirement is satisfied.

Juniors and seniors who participate in the UC Education Abroad Program (EAP) for a full year may meet a modified senior residence requirement. After 60 units toward the bachelor's degree have been completed, at least 24 (excluding EAP) of the remaining units must be completed in residence in the College of Chemistry, in at least two semesters. At least 12 of the 24 units must be completed after the student has already completed 90 units. Undergraduate Dean's approval for the modified senior residence requirement must be obtained before enrollment in the Education Abroad Program.

## Minimum Total Units

A student must successfully complete at least 120 semester units in order to graduate.

## Minimum Academic Requirements

### Grades

A student must earn at least a C average (2.0 GPA) in all courses undertaken at UC, including those from UC Summer Sessions, UC Education Abroad Program, and UC Berkeley Washington Program, as well as XB courses from University Extension.

## Minimum Course Grade Requirements

Students in the College of Chemistry who receive a grade of D+ or lower in a chemical and biomolecular engineering or chemistry course for which a grade of C- or higher is required must repeat the course at Berkeley.

Students in the College of Chemistry must achieve:

- C- or higher in CHEM 4A (<http://guide.berkeley.edu/search/?P=CHEM%204A>) before taking CHEM 4B (<http://guide.berkeley.edu/search/?P=CHEM%204B>)
- C- or higher in CHEM 4B (<http://guide.berkeley.edu/search/?P=CHEM%204B>) before taking more advanced courses
- C- or higher in CHEM 12A (<http://guide.berkeley.edu/search/?P=CHEM%2012A>) before taking CHEM 12B (<http://guide.berkeley.edu/search/?P=CHEM%2012B>)
- GPA of at least 2.0 in all courses taken in the college in order to advance to and continue in the upper division

Chemistry or chemical biology majors must also achieve:

- C- or higher in CHEM 120A (<http://guide.berkeley.edu/search/?P=CHEM%20120A>) and CHEM 120B (<http://guide.berkeley.edu/search/?P=CHEM%20120B>) if taken before CHEM 125 (<http://guide.berkeley.edu/search/?P=CHEM%20125>) or CHEM C182 (<http://guide.berkeley.edu/search/?P=CHEM%20C182>)
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students must also achieve:

- C- or higher in Chemical and Biomolecular Engineering (CBE) 140 before taking any other CBE courses
- C- or higher in CHM ENG 150A (<http://guide.berkeley.edu/search/?P=CHM%20ENG%20150A>) to be eligible to take any other course in the 150 series
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students who do not achieve a grade of C- or higher in CHM ENG 140 (<http://guide.berkeley.edu/search/?P=CHM%20ENG%20140>) on their first attempt are advised to change to another major. If the course is not passed with a grade of C- or higher on the second attempt, continuation in the Chemical Engineering program is normally not allowed.

## Minimum Progress

To make normal progress toward a degree, undergraduates must successfully complete 30 units of coursework each year. The continued enrollment of students who do not maintain normal progress will be subject to the approval of the Undergraduate Dean. To achieve minimum academic progress, the student must meet two criteria:

1. Completed no fewer units than 15 multiplied by the number of semesters, less one, in which the student has been enrolled at Berkeley. Summer sessions do not count as semesters for this purpose.
2. A student's class schedule must contain at least 13 units in any term, unless otherwise authorized by the staff adviser or the Undergraduate Dean.

## University of California Requirements

Entry Level Writing (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/entry-level-writing-requirement>)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/american-history-institutions-requirement>)

The American History and Institutions requirements are based on the principle that a U.S. resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

## Campus Requirement

American Cultures (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/american-cultures-requirement>)

American Cultures (AC) is the one requirement that all undergraduate students at UC Berkeley need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the

study of race, ethnicity and culture in the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), please see the Major Requirements tab.

Freshman				
	Fall	Units	Spring	Units
MATH 1A		4	MATH 1B	4
CHEM 4A or 1A <i>and</i> 1AL		4	ENGIN 7	4
English R1A or equivalent		4	PHYSICS 7A	4
Breadth Elective		3	CHEM 4B or 1B	4
		15		16
Sophomore				
	Fall	Units	Spring	Units
PHYSICS 7B		4	MATH 54	4
MATH 53		4	PHYSICS 7C	4
CHM ENG 140		4	CHM ENG 141	4
Breadth Elective		3	CHM ENG 150	4
		15		16
Junior				
	Fall	Units	Spring	Units
ENGIN 117		3	NUC ENG 104	4
NUC ENG 101		4	Breadth Elective or CHM ENG 185	6
CHM ENG 142		4	Up to 3 units of Breadth can be satisfied by CHM ENG 185	
CHM ENG 150B		4	NUC ENG 162 or BIOLOGY 1A	3
MAT SCI 45		3	NUC ENG 150	4
MAT SCI 45L		1		
		19		17
Senior				
	Fall	Units	Spring	Units
Nuclear Engineering Electives		6	CHM ENG 160 or NUC ENG 170A	3-4
CHEM 120A or PHYSICS 137A		3-4	CHM ENG 162	4
CHM ENG 154		4	Breadth Electives	6
Upper Division Engineering Elective		3-4		
		16-18		13-14
<b>Total Units: 127-130</b>				

## Chemical Engineering/Nuclear Engineering

### CHM ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2015, Fall 2014, Spring 2014

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.

Freshman Seminars: Read More [+]

#### Rules & Requirements

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

Freshman Seminars: Read Less [-]

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

Terms offered: Fall 2018, Fall 2017, Fall 2016

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.

Introduction to Chemical Engineering Design: Read More [+]

#### 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.

Introduction to Chemical Engineering Design: Read Less [-]

## 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.

Sophomore Seminar: Read More [+]

### Rules & Requirements

**Prerequisites:** At discretion of instructor

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

Sophomore Seminar: Read Less [-]

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

Terms offered: Spring 2018, Spring 2016, Spring 2015

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.

Science and Engineering of Sustainable Energy: Read More [+]

### 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

Science and Engineering of Sustainable Energy: Read Less [-]

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

Terms offered: Fall 2018, Spring 2018, Fall 2017

Supervised research on a specific topic.

Directed Group Studies for Lower Division Undergraduates: Read More [+]

### 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.

Directed Group Studies for Lower Division Undergraduates: Read Less [-]



**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.

Directed Group Study: Read More [\[+\]](#)

**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. 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.

Directed Group Study: Read Less [\[-\]](#)

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

Terms offered: Fall 2018, Fall 2017, Fall 2016

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

Introduction to Chemical Process Analysis: Read More [\[+\]](#)

**Rules & Requirements**

**Prerequisites:** Chemistry 4B or 1B with a grade of C- or better; 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.

Introduction to Chemical Process Analysis: Read Less [\[-\]](#)

**CHM ENG 141 Chemical Engineering Thermodynamics 4 Units**

Terms offered: Spring 2018, Spring 2016, Spring 2015

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

Chemical Engineering Thermodynamics: Read More [\[+\]](#)

**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.

Chemical Engineering Thermodynamics: Read Less [\[-\]](#)

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

Terms offered: Fall 2018, Fall 2017, Fall 2016

Analysis and prediction of rates of chemical conversion in flow and nonflow processes involving homogeneous and heterogeneous systems. Chemical Kinetics and Reaction Engineering: Read More [\[+\]](#)

**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.

Chemical Kinetics and Reaction Engineering: Read Less [\[-\]](#)

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

Terms offered: Spring 2016

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... Computational Methods in Chemical Engineering: Read More [+]

### 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.

Computational Methods in Chemical Engineering: Read Less [-]

## CHM ENG 150A Transport Processes 4 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015

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.

Transport Processes: Read More [+]

### 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.

Transport Processes: Read Less [-]

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

Terms offered: Fall 2018, Fall 2017, Fall 2016

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.

Transport and Separation Processes: Read More [+]

### 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.

Transport and Separation Processes: Read Less [-]

## CHM ENG 154 Chemical Engineering Laboratory 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

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. Chemical Engineering Laboratory: Read More [\[+\]](#)

### 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.

Chemical Engineering Laboratory: Read Less [\[-\]](#)

## CHM ENG 160 Chemical Process Design 4 Units

Terms offered: Fall 2018, Summer 2018 8 Week Session, Spring 2018  
Design principles of chemical process equipment. Design of integrated chemical processes with emphasis upon economic considerations. Chemical Process Design: Read More [\[+\]](#)

### 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.

Chemical Process Design: Read Less [\[-\]](#)

## 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  
Industrial Chemical Process Design: Read More [\[+\]](#)

### 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

Industrial Chemical Process Design: Read Less [\[-\]](#)

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

Terms offered: Fall 2018, Spring 2018, Fall 2017

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

Dynamics and Control of Chemical Processes: Read More [\[+\]](#)

### 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.

Dynamics and Control of Chemical Processes: Read Less [\[-\]](#)



## CHM ENG 170A Biochemical Engineering 3 Units

Terms offered: Fall 2018, Fall 2016, Spring 2016

This course intends to introduce chemical engineers to the basic concepts of biochemical engineering. The course focuses on the use of chemical engineering skills and principles in the analysis and design of biologically-based processes. The main emphasis will be on biochemical kinetics, heat and mass transfer, thermodynamics, and transport phenomena as they apply to enzyme catalysis, microbial growth and metabolism, fermentation and bioreactor design, product recovery and downstream processing. Fundamental topics in biological sciences will be introduced as necessary throughout the course.

Biochemical Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Chemical and Biomolecular Engineering 142, 150B, or consent of instructor; Biology 1A

### 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.

**Instructor:** Clark

Biochemical Engineering: Read Less [-]

## CHM ENG 170B Biochemical Engineering 3 Units

Terms offered: Spring 2014, Spring 2013, Spring 2012

The second of a two-semester sequence intended to introduce chemical engineers to the basic concepts of biochemical engineering. The course focuses on the use of chemical engineering skills and principles in the analysis and design of biologically-based processes. The emphasis will be on biochemical kinetics, protein engineering, cell growth and metabolism, bioreactor design, downstream processing, pharmacokinetics, drug delivery, and ethics.

Biochemical Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** 170A: Chemistry 135 or Molecular and Cell Biology 102, which may be taken concurrently

### 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.

**Instructor:** Clark

**Formerly known as:** 170

Biochemical Engineering: Read Less [-]

## CHM ENG C170L Biochemical Engineering Laboratory 3 Units

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

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

Biochemical Engineering Laboratory: Read More [+]

### 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

Biochemical Engineering Laboratory: Read Less [-]

**CHM ENG 171 Transport Phenomena 3 Units**

Terms offered: Fall 2018, Spring 2011, Spring 2009

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

Transport Phenomena: Read More [+]

**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.

Transport Phenomena: Read Less [-]

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

Terms offered: Spring 2018, Fall 2016, Fall 2014

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

Principles of Electrochemical Processes: Read More [+]

**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.

Principles of Electrochemical Processes: Read Less [-]

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

Terms offered: Spring 2018, 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.

Polymer Science and Technology: Read More [+]

**Rules & Requirements**

**Prerequisites:** Junior standing

**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.

**Instructor:** Segalman

**Also listed as:** CHEM C178

Polymer Science and Technology: Read Less [-]

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

Terms offered: Fall 2018, Fall 2017, Fall 2016

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. Process Technology of Solid-State Materials Devices: Read More [+]

**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.

Process Technology of Solid-State Materials Devices: Read Less [-]

## CHM ENG 180 Chemical Engineering Economics 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Chemical Engineering Economics: Read More [a+]

### 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.

Chemical Engineering Economics: Read Less [-]

## CHM ENG 182 Nanoscience and Engineering Biotechnology 3 Units

Terms offered: Fall 2018

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.

Nanoscience and Engineering Biotechnology: Read More [a+]

### 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. Final exam required.

**Instructor:** Landry

Nanoscience and Engineering Biotechnology: Read Less [-]

## 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.

Senior Honors Thesis: Read More [a+]

### 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.

Senior Honors Thesis: Read Less [-]

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

Terms offered: Summer 2016 10 Week Session, Spring 2016, Fall 2015

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

Research for Advanced Undergraduates: Read More [a+]

### 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.

Research for Advanced Undergraduates: Read Less [-]

**CHM ENG 195 Special Topics 2 - 4 Units**

Terms offered: Fall 2018, Fall 2017, Spring 2016

Fall 2017's Special Topic: Nanoscience and Engineering Biotechnology

This nanoscale science and biomolecular engineering course will cover emerging topics in applied biotechnology. Topics include bioanalytical chemistry, recombinant protein generation and purification, cell culture, immunology, nanomaterials in biology, bio-toxicity, and biomolecular sensors. The scope of the course will also probe the interface of biology with nanomaterials, and standard microscopic and spectroscopic techniques to image both biological structures and nanoscale materials. Special Topics: Read More [+]

**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.

Special Topics: Read Less [-]

**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.

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

**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. 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

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

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

Terms offered: Spring 2016, Fall 2015, Spring 2015

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

Special Laboratory Study: Read More [\[+\]](#)

### 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.

Special Laboratory Study: Read Less [\[-\]](#)

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

Terms offered: Spring 2016, Fall 2015, Spring 2015

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.

Field Study in Chemical Engineering: Read More [\[+\]](#)

### 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

Field Study in Chemical Engineering: Read Less [\[-\]](#)

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

Terms offered: Fall 2018, Spring 2018, Fall 2017

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

Directed Group Study for Undergraduates: Read More [\[+\]](#)

### 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.

Directed Group Study for Undergraduates: Read Less [\[-\]](#)

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

Terms offered: Spring 2016, Fall 2015, Spring 2015

Supervised Independent Study and Research: Read More [\[+\]](#)

### 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.

Supervised Independent Study and Research: Read Less [\[-\]](#)



## Nuclear Engineering

### NUC ENG 24 Freshman Seminars 1 Unit

Terms offered: Fall 2018, Spring 2018, Fall 2017

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.

Freshman Seminars: Read More [a+]

#### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes. 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:** Nuclear Engineering/Undergraduate

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

Freshman Seminars: Read Less [-]

### NUC ENG 100 Introduction to Nuclear Engineering 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

The class provides students with an overview of the contemporary nuclear energy technology with emphasis on nuclear fission as an energy source. Starting with the basic physics of the nuclear fission process, the class includes discussions on reactor control, thermal hydraulics, fuel production, and spent fuel management for various types of reactors in use around the world as well as analysis of safety and other nuclear-related issues. This class is intended for sophomore NE students, but is also open to transfer students and students from other majors.

Introduction to Nuclear Engineering: Read More [a+]

#### Rules & Requirements

**Prerequisites:** Physics 7A and 7B, Physics 7C may be taken concurrently. Mathematics 53 and 54 may be taken concurrently

#### Hours & Format

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

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Introduction to Nuclear Engineering: Read Less [-]

### NUC ENG 101 Nuclear Reactions and Radiation 4 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Energetics and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.

Nuclear Reactions and Radiation: Read More [a+]

#### Rules & Requirements

**Prerequisites:** Physics 7C

#### Hours & Format

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

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructors:** Bernstein, L.

Nuclear Reactions and Radiation: Read Less [-]

### NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2013

Laboratory course in nuclear physics. Experiments will allow students to directly observe phenomena discussed in Nuclear Engineering 101. These experiments will give students exposure to (1) electronics, (2) alpha, beta, gamma radiation detectors, (3) radioactive sources, and (4) experimental methods relevant for all aspects of nuclear science. Experiments include: Rutherford scattering, x-ray fluorescence, muon lifetime, gamma-gamma angular correlations, Mossbauer effect, and radon measurements.

Nuclear Reactions and Radiation Laboratory: Read More [a+]

#### Rules & Requirements

**Prerequisites:** 101

#### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture, 1 hour of discussion, and 4 hours of laboratory per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Norman

Nuclear Reactions and Radiation Laboratory: Read Less [-]

## NUC ENG 104 Radiation Detection and Nuclear Instrumentation Laboratory 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Basic science of radiation measurement, nuclear instrumentation, neutronics, radiation dosimetry. The lectures emphasize the principles of radiation detection. The weekly laboratory applies a variety of radiation detection systems to the practical measurements of interest for nuclear power, nuclear and non-nuclear science, and environmental applications. Students present goals and approaches of the experiments being performed.

Radiation Detection and Nuclear Instrumentation Laboratory: Read More [+]

### Rules & Requirements

**Prerequisites:** 101 or equivalent or consent of instructor; 150 or equivalent recommended

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vetter

**Formerly known as:** 104A

Radiation Detection and Nuclear Instrumentation Laboratory: Read Less [-]

## NUC ENG 107 Introduction to Imaging 3 Units

Terms offered: Fall 2018, Fall 2016, Fall 2014

Introduction to medical imaging physics and systems, including x-ray computed tomography (CT), nuclear magnetic resonance (NMR), positron emission tomography (PET), and SPECT; basic principles of tomography and an introduction to unfolding methods; resolution effects of counting statistics, inherent system resolution and human factors.

Introduction to Imaging: Read More [+]

### Rules & Requirements

**Prerequisites:** 101 and 104A or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vetter

Introduction to Imaging: Read Less [-]

## NUC ENG 120 Nuclear Materials 4 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Effects of irradiation on the atomic and mechanical properties of materials in nuclear reactors. Fission product swelling and release; neutron damage to structural alloys; fabrication and properties of uranium dioxide fuel.

Nuclear Materials: Read More [+]

### Rules & Requirements

**Prerequisites:** Engineering 45 and an upper division course in thermodynamics

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Wirth

Nuclear Materials: Read Less [-]

## NUC ENG 124 Radioactive Waste Management 3 Units

Terms offered: Spring 2017, Spring 2016, Spring 2015

Components and material flowsheets for nuclear fuel cycle, waste characteristics, sources of radioactive wastes, compositions, radioactivity and heat generation; waste treatment technologies; waste disposal technologies; safety assessment of waste disposal.

Radioactive Waste Management: Read More [+]

### Rules & Requirements

**Prerequisites:** Engineering 117 or equivalent course

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Ahn

Radioactive Waste Management: Read Less [-]

## NUC ENG 130 Analytical Methods for Non-proliferation 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Use of nuclear measurement techniques to detect clandestine movement and/or possession of nuclear materials by third parties. Nuclear detection, forensics, signatures, and active and passive interrogation methodologies will be explored. Techniques currently deployed for arms control and treaty verification will be discussed. Emphasis will be placed on common elements of detection technology from the viewpoint of resolution of threat signatures from false positives due to naturally occurring radioactive material. Topics include passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination.

Analytical Methods for Non-proliferation: [Read More](#) [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 101 or equivalent course in nuclear physics, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Morse

Analytical Methods for Non-proliferation: [Read Less](#) [\[-\]](#)

## NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Neutron interactions, nuclear fission, and chain reacting systematics in thermal and fast nuclear reactors. Diffusion and slowing down of neutrons. Criticality calculations. Nuclear reactor dynamics and reactivity feedback. Production of radionuclides in nuclear reactors.

Introduction to Nuclear Reactor Theory: [Read More](#) [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 101; Mathematics 53 and 54

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructors:** Greenspan, Vujic

Introduction to Nuclear Reactor Theory: [Read Less](#) [\[-\]](#)

## NUC ENG 155 Introduction to Numerical Simulations in Radiation Transport 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Computational methods used to analyze radiation transport described by various differential, integral, and integro-differential equations. Numerical methods include finite difference, finite elements, discrete ordinates, and Monte Carlo. Examples from neutron and photon transport; numerical solutions of neutron/photon diffusion and transport equations. Monte Carlo simulations of photon and neutron transport. An overview of optimization techniques for solving the resulting discrete equations on vector and parallel computer systems.

Introduction to Numerical Simulations in Radiation Transport: [Read More](#) [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Mathematics 53 and 54

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructors:** Vujic, Wirth

Introduction to Numerical Simulations in Radiation Transport: [Read Less](#) [\[-\]](#)

## NUC ENG 156 Nuclear Criticality Safety 3 Units

Terms offered: Not yet offered

This course provides an introduction to the field of nuclear criticality safety. Topics include: a review of basic concepts related to criticality (fission, cross sections, multiplication factor, etc.); criticality safety accidents; standards applicable to criticality safety; hand calculations and Monte Carlo methods used in criticality safety analysis; criticality safety evaluation documents.

Nuclear Criticality Safety: Read More [+]

### Objectives Outcomes

**Course Objectives:** The objective of this course is to acquaint Nuclear Engineering students with the concepts and practice of nuclear criticality safety, and to help prepare them for a future career in this field.

**Student Learning Outcomes:** At the end of this course, students should be able to:

Explain and define criticality safety factors for operations.

Discuss previous criticality accidents and their causal factors, including parameters involved in solution and metal critical accidents.

Identify and discuss the application of several common hand calculation methods.

Describe the importance of validation of computer codes and how it is accomplished.

Discuss ANSI/ANS criticality safety regulations.

Describe DOE regulations and practices in the nuclear criticality safety field.

Complete a Criticality Safety Evaluation.

### Rules & Requirements

**Prerequisites:** Nuc Eng 150, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Fratoni

Nuclear Criticality Safety: Read Less [-]

## NUC ENG 161 Nuclear Power Engineering 4 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Energy conversion in nuclear power systems; design of fission reactors; thermal and structural analysis of reactor core and plant components; thermal-hydraulic analysis of accidents in nuclear power plants; safety evaluation and engineered safety systems.

Nuclear Power Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Course(s) in fluid mechanics and heat transfer; junior-level course in thermodynamics

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Peterson

Nuclear Power Engineering: Read Less [-]

## NUC ENG 162 Radiation Biophysics and Dosimetry 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Interaction of radiation with matter; physical, chemical, and biological effects of radiation on human tissues; dosimetry units and measurements; internal and external radiation fields and dosimetry; radiation exposure regulations; sources of radiation and radioactivity; basic shielding concepts; elements of radiation protection and control; theories and models for cell survival, radiation sensitivity, carcinogenesis, and dose calculation.

Radiation Biophysics and Dosimetry: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vujic

Radiation Biophysics and Dosimetry: Read Less [-]

## NUC ENG 167 Risk-Informed Design for Advanced Nuclear Systems 3 Units

Terms offered: Fall 2017, Fall 2015, Fall 2014

Project-based class for design and licensing of nuclear facilities, including advanced reactors. Elements of a project proposal. Regulatory framework and use of deterministic and probabilistic licensing criteria. Siting criteria. External and internal events. Identification and analysis of design basis and beyond design basis events. Communication with regulators and stakeholders. Ability to work in and contribute to a design team.

Risk-Informed Design for Advanced Nuclear Systems: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** \* Introduce students to the methods and models for event identification, accident analysis, and risk assessment and management for internally and externally initiated events.

\* Introduce students to the regulatory requirements for design, construction and operation of nuclear facilities licensed by the U.S. Nuclear Regulatory Commission.

\* Introduce students to the safety principles and methods used to design, construct and operate a safe nuclear facility, for a specific site and application.

\* Provide a basic understanding of similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

\* Provide a basic understanding the risk-informed design process and an opportunity to experience contributing in a focused area to a design project.

\* Provide students with experiential knowledge in developing schedules, allocating work responsibilities, and working in teams.

\* Provide students with experiential knowledge in the preparation and evaluation a Safety Analysis Report for meeting USNRC regulatory requirements, including response to Requests for Additional Information (RAIs).

**Student Learning Outcomes:** \* Develop a broad understanding of safety principles and methods used in design, construction and licensing of nuclear facilities.

\* Develop a broad understanding of the U.S. Nuclear Regulatory Commission's regulatory requirements for nuclear facilities.

\* Have awareness of key similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

\* Have awareness of the major topics covered in a Safety Analysis Report (SAR) and experience in developing and writing at least one element of a SAR.

\* Have developed experience and skills in communication with the business community, the public, and regulators.

\* Have developed experience and skills in establishing a project schedule, allocating work responsibilities, and working in teams.

\* Have understanding of application of event identification, event frequency and consequence analysis, risk assessment and management for internally and externally initiated events in the design process.

### Rules & Requirements

**Prerequisites:** Completion of at least two upper-division engineering courses providing relevant skills: ChemE 150A, ChemE 180, CE 111, CE 120, CE152, CE 166, CE 175, E 120, IEOR 166, IEOR 172, ME 106, ME 109, ME 128, ME 146, NE 120, NE 124, NE 150, NE 161

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

## NUC ENG 170A Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Design of various fission and fusion power systems and other physically based applications. Each semester a topic will be chosen by the class as a whole. In addition to technology, the design should address issues relating to economics, the environment, and risk assessment.

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: [Read More](#) [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Formerly known as:** 170

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: [Read Less](#) [-]

## NUC ENG 170B Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy 3 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008

A systems approach to the development of procedures for nuclear medicine and radiation therapy. Each semester a specific procedure will be studied and will entail the development of the biological and physiological basis for a procedure, the chemical and biochemical characteristics of appropriate drugs, dosimetric requirements and limitations, the production and distribution of radionuclides and/or radiation fields to be applied, and the characteristics of the instrumentation to be used.

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 107, 161, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Formerly known as:** 167

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: [Read Less](#) [-]



## NUC ENG 175 Methods of Risk Analysis 3 Units

Terms offered: Fall 2018, Fall 2013, Fall 2011

Methodological approaches for the quantification of technological risk and risk based decision making. Probabilistic safety assessment, human health risks, environmental and ecological risk analysis.

Methods of Risk Analysis: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Upper division standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Kastenberg

Methods of Risk Analysis: [Read Less](#) [-]

## NUC ENG 180 Introduction to Controlled Fusion 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Introduction to energy production by controlled thermonuclear reactions. Nuclear fusion reactions, energy balances for fusion systems, survey of plasma physics; neutral beam injection; RF heating methods; vacuum systems; tritium handling.

Introduction to Controlled Fusion: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Physics 7C

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Morse

Introduction to Controlled Fusion: [Read Less](#) [-]

## NUC ENG H194 Honors Undergraduate Research 1 - 4 Units

Terms offered: Fall 2018, Summer 2018, Spring 2018

Supervised research. Students who have completed three or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of three units of H194 may be used to fulfill a technical elective requirement in the Nuclear Engineering general program or joint major programs.

Honors Undergraduate Research: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Upper division technical GPA of 3.3, consent of instructor and faculty advisor

**Repeat rules:** Course may be repeated for credit up to a total of 8 units. Course may be repeated for a maximum of 8 units.

### Hours & Format

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

**Summer:** 10 weeks - 1.5-6 hours of independent study per week

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Honors Undergraduate Research: [Read Less](#) [-]

## NUC ENG 198 Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Group studies of selected topics.

Group Study for Advanced Undergraduates: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Upper division standing

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Group Study for Advanced Undergraduates: [Read Less](#) [-]

## NUC ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.

Supervised Independent Study: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**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:** Nuclear Engineering/Undergraduate

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

Supervised Independent Study: Read Less [\[-\]](#)

## NUC ENG S199 Supervised Independent Study 1 - 4 Units

Terms offered: Prior to 2007

Supervised independent study. Please see section of the for description and prerequisites.

Supervised Independent Study: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**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:** Nuclear Engineering/Undergraduate

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

Supervised Independent Study: Read Less [\[-\]](#)