**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**

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/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 X8 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.

Please note, the Academic Guide is updated only once a year. For the most current information on requirements please a look at the College of Chemistry website (https://chemistry.berkeley.edu/ugrad/degrees/cheme/joint-majors/).

### Lower Division Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1B</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 53</td>
<td>Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 54</td>
<td>Linear Algebra and Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 1AL</td>
<td>and General Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>or CHEM 4A</td>
<td>General Chemistry and Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1B</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 4B</td>
<td>General Chemistry and Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 7A</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 7B</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 7C</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>ENGIN 7</td>
<td>Introduction to Computer Programming for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>MAT SCI 45</td>
<td>Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>MAT SCI 45L</td>
<td>Properties of Materials Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

### Upper Division Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 120A</td>
<td>Physical Chemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>or PHYSICS 130</td>
<td>Quantum Mechanics</td>
<td></td>
</tr>
<tr>
<td>CHM ENG 140</td>
<td>Introduction to Chemical Process Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 141</td>
<td>Chemical Engineering Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 142</td>
<td>Chemical Kinetics and Reaction Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 150A</td>
<td>Transport Processes</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 150B</td>
<td>Transport and Separation Processes</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 154</td>
<td>Chemical Engineering Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHM ENG 160</td>
<td>Chemical Process Design</td>
<td>4</td>
</tr>
<tr>
<td>or NUC ENG 1</td>
<td>Nuclear Design: Design in Nuclear Power Technology and Instrumentation</td>
<td></td>
</tr>
<tr>
<td>CHM ENG 162</td>
<td>Dynamics and Control of Chemical Processes</td>
<td>4</td>
</tr>
<tr>
<td>ENGIN 117</td>
<td>Methods of Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>NUC ENG 101</td>
<td>Nuclear Reactions and Radiation</td>
<td>4</td>
</tr>
<tr>
<td>NUC ENG 104</td>
<td>Radiation Detection and Nuclear Instrumentation Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>NUC ENG 150</td>
<td>Introduction to Nuclear Reactor Theory</td>
<td>4</td>
</tr>
<tr>
<td>NUC ENG 162</td>
<td>Radiation Biophysics and Dosimetry</td>
<td>3</td>
</tr>
<tr>
<td>or BIOLOGY 1</td>
<td>General Biology Lecture</td>
<td></td>
</tr>
</tbody>
</table>

Nuclear engineering electives: select 6 units of upper division NUC ENG courses

Engineering electives: select 3-4 units of upper division engineering courses.

All students in the College of Chemistry are required to complete the University requirements of American Cultures (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/american-cultures-requirement/), American History and Institutions (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/american-history-institutions-requirements/), and Entry-Level Writing (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/entry-
level-writing-requirement/). In addition, they must satisfy the following College requirements:


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 Reading and Composition course (e.g., English R1A) by end of the first year
- R&C courses must be taken for a letter grade
- English courses at other institutions may satisfy the requirement(s); check with your Undergraduate Adviser
- After admission to Berkeley, credit for English at another institution will not be granted if the Entry Level Writing requirement has not been satisfied

**Humanities and Social Sciences Breadth Requirement: Chemistry & Chemical Biology majors**

The College of Chemistry's humanities and social sciences breadth requirement promotes educational experiences that enrich and complement the technical requirements for each major.

- 15 units total; includes Reading & Composition and American Cultures courses
- Remaining units must come from the following L&S breadth areas, excluding courses which only teach a skill (such as drawing or playing an instrument):
  - Arts and Literature
  - Foreign Language ([http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/](http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/))
  - Historical Studies
  - International Studies
  - Philosophy and Values
  - Social and Behavioral Sciences

To find course options for breadth, go to the Berkeley Academic Guide Class Schedule ([http://classes.berkeley.edu/](http://classes.berkeley.edu/)), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a Pass/No Pass basis (excluding Reading and Composition)
- AP, IB, and GCE A-level exam credit ([http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/](http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/)) may be used to satisfy the breadth requirement

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1 Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

2 For Chemistry and Chemical Biology majors, elementary-level foreign language courses are not accepted toward the 15 unit breadth requirement if they are used (or are duplicates of high school courses used) to satisfy the Foreign Language requirement.

**Foreign Language (Language Other Than English [LOTE]) Requirement**

 Applies to Chemistry and Chemical Biology majors only.

The LOTE requirement may be satisfied with one language other than English, in one of the following ways:

- By completing in high school the third year of one language other than English with minimum grades of C-.
- By completing at Berkeley the second semester of a sequence of courses in one language other than English, or the equivalent at another institution. Only LOTE courses that include reading and composition, as well as conversation, are accepted in satisfaction of this requirement. LOTE courses may be taken on a Pass/No Pass basis.
- By demonstrating equivalent knowledge of a language other than English 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.

**Humanities and Social Sciences Breadth Requirement: Chemical Engineering major**

- 22 units total; includes Reading and Composition 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 following lists of approved humanities and social science courses, excluding courses which only teach a skill (such as drawing or playing an instrument):
  - Arts and Literature
  - Foreign Language ([http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/](http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/))
  - Historical Studies
  - International Studies
  - Philosophy and Values
  - Social and Behavioral Sciences

To find course options for breadth, go to the Berkeley Academic Guide Class Schedule ([http://classes.berkeley.edu/](http://classes.berkeley.edu/)), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a Pass/No Pass basis (excluding Reading and Composition)
• AP, IB, and GCE A-level exam (http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/) credit may be used to satisfy the breadth requirement

1 Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

2 For chemical engineering majors, no more that six units of language other than English may be counted toward the 22 unit 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 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
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 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 before taking CHEM 4B
• C- or higher in CHEM 4B before taking more advanced courses
• C- or higher in CHEM 12A before taking CHEM 12B
• 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 and CHEM 120B if taken before CHEM 125 or CHEM C182
• 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 CHM ENG 140 before taking any other CBE courses
• C- or higher in CHM ENG 150A 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 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.
University of California Requirements

Entry Level Writing ([http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext](http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext))

All students who will enter the University of California as freshmen must demonstrate their command of the English language by satisfying the Entry Level Writing Requirement (ELWR). The UC Entry Level Writing Requirement website ([https://admission.universityofcalifornia.edu/elwr/](https://admission.universityofcalifornia.edu/elwr/)) provides information on how to satisfy the requirement.

American History and American Institutions ([http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext](http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext))

The American History and Institutions (AH&I) 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.

Campus Requirement

American Cultures ([http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext](http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext))

The American Cultures requirement is a Berkeley campus requirement, one that all undergraduate students at Berkeley need to pass in order to graduate. You satisfy the requirement by passing, with a grade not lower than C- or P, an American Cultures course. You may take an American Cultures course any time during your undergraduate career at Berkeley. The requirement was instituted in 1991 to introduce students to the diverse cultures of the United States through a comparative framework. Courses are offered in more than fifty departments in many different disciplines at both the lower and upper division level.

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

Chemical Engineering

MISSION

The goals of chemical engineering breadth requirements are to teach the arts of writing clearly and persuasively, to develop the skills to read carefully and evaluate evidence effectively, and to instill an awareness of humanity in historical and social contexts. The Berkeley American Cultures requirement affirms the value of diversity in acquiring knowledge.

The technical curriculum in chemical engineering seeks to provide students with a broad education emphasizing an excellent foundation in scientific and engineering fundamentals.

LEARNING GOALS

1. An ability to identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in a global, economic, environmental, and societal context
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Nuclear Engineering

Mission

The mission of the Department of Nuclear Engineering is to maintain and strengthen the University of California’s only center of excellence in nuclear engineering education and research and to serve California and the nation by improving and applying nuclear science and technology. The mission of the undergraduate degree program in Nuclear
Engineering is to prepare our students to begin a lifetime of technical achievement and professional leadership in academia, government, the national laboratories, and industry.

Learning Goals

The foundation of the UC Berkeley Nuclear Engineering (NE) program is a set of five key objectives for educating undergraduate students. The NE program continuously reviews these objectives internally to ensure that they meet the current needs of the students, and each spring the Program Advisory Committee meets to review the program and recommend changes to better serve students. The NE Program Advisory Committee was established in 1988 and is composed of senior leaders from industry, the national laboratories, and academia.

Nuclear engineering at UC Berkeley prepares undergraduate students for employment or advanced studies with four primary constituencies: industry, the national laboratories, state and federal agencies, and academia (graduate research programs). Graduate research programs are the dominant constituency. From 2000 to 2005, sixty-eight percent of graduating NE seniors indicated plans to attend graduate school in their senior exit surveys. To meet the needs of these constituencies, the objectives of the NE undergraduate program are to produce graduates who as practicing engineers and researchers do the following:

1. Apply solid knowledge of the fundamental mathematics and natural (both physical and biological) sciences that provide the foundation for engineering applications.
2. Demonstrate an understanding of nuclear processes, and the application of general natural science and engineering principles to the analysis and design of nuclear and related systems of current and/or future importance to society.
3. Exhibit strong, independent learning, analytical and problem-solving skills, with special emphasis on design, communication, and an ability to work in teams.
4. Demonstrate an understanding of the broad social, ethical, safety, and environmental context within which nuclear engineering is practiced.

Chemical Engineering/Nuclear Engineering

Expand all course descriptions [+]Collapse all course descriptions [-]
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.
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 2023, Spring 2022, Spring 2021
An introduction is given to the science and technologies of producing electricity and transportation fuels from renewable energy resources (biomass, geothermal, solar, wind, and wave). Students will be introduced to quantitative calculations and comparisons of energy technologies together with the economic and political factors affecting the transition from nonrenewable to sustainable energy resources. Mass and energy balances are used to analyze the conversion of energy resources.
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: Spring 2023, Fall 2022, Spring 2022
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.

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 101 Chemical Business Fundamentals I 4 Units
Terms offered: Prior to 2007
This upper division course for science and engineering students is the
first of a two-course series that covers the business fundamentals for
technology professionals. This course is only offered as part of a four-
course summer minor program in Responsible Process Implementation
within the Department of Chemical & Biomolecular Engineering. Through
the use of applicable cases and examples from the chemical and process
industries, students will learn the basic concept of business and the
role that technology professionals are expected to play in a business
environment.
Chemical Business Fundamentals I: Read More [+]

Hours & Format
Summer: 6 weeks - 10 hours of lecture and 3 hours of discussion per
week

Additional Details
Subject/Course Level: Chemical & Biomolecular Engineering/
Undergraduate
Grading/Final exam status: Letter grade. Alternate method of
final assessment during regularly scheduled final exam group (e.g.,
presentation, final project, etc.).

Chemical Business Fundamentals I: Read Less [-]

CHM ENG 102 Chemical Business Fundamentals II 4 Units
Terms offered: Prior to 2007
This upper division course for science and engineering students
is the continuation of a two-course series that covers the business
fundamentals for technology professionals. This course is only offered
as part of a four-course summer minor program in Responsible Process Implementation within the Department of Chemical & Biomolecular Engineering. It is intended to introduce the marketing, product
development, and operational aspects of a business enterprise, to help
technology professionals optimize their effectiveness when performing
their duties within a multifunctional organization, and to illuminate the
effects of their actions and decisions on the performance of a business
entity.
Chemical Business Fundamentals II: Read More [+]

Rules & Requirements
Prerequisites: CHMENG S101

Hours & Format
Summer: 6 weeks - 10 hours of lecture and 3 hours of discussion per
week

Additional Details
Subject/Course Level: Chemical & Biomolecular Engineering/
Undergraduate
Grading/Final exam status: Letter grade. Alternate method of
final assessment during regularly scheduled final exam group (e.g.,
presentation, final project, etc.).

Chemical Business Fundamentals II: Read Less [-]
**CHM ENG 103 New Process Implementation: Concept to Commercialization 3 Units**

Terms offered: Prior to 2007

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

New Process Implementation: Concept to Commercialization: Read More [+]

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

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

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

New Process Implementation: Concept to Commercialization: Read Less [-]

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

Terms offered: Prior to 2007

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

Ethics and Professional Social Responsibility: Read More [+]

**Rules & Requirements**

**Prerequisites:** CHM ENG 101

**Hours & Format**

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

**Additional Details**

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

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

Ethics and Professional Social Responsibility: Read Less [-]

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

Terms offered: Fall 2023, Fall 2022

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

Mathematics and Statistics in Chemical Engineering: Read More [+]

**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.

Mathematics and Statistics in Chemical Engineering: Read Less [-]
CHM ENG 140 Introduction to Chemical Process Analysis 4 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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 (may be taken concurrently) or Chemistry 1B; and Physics 7B (may be taken concurrently)

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Additional Details
Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Introduction to Chemical Process Analysis: Read Less [-]

CHM ENG 141 Chemical Engineering Thermodynamics 4 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
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 2023, Fall 2022, Spring 2022
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 2023, Spring 2022, Spring 2021
The purpose of Chemical Engineering Modeling and Computations in Chemical Engineering is to teach students the methodologies used in setting up mathematical models of simple chemical processes and operations, and the numerical techniques used to simulate them. Included are techniques to obtain physical properties of mixtures/solutions using equations of state. This is followed by simple processes such as vapor liquid equilibrium, separation operations such as distillation, heat transfer, and chemical reactions in ideal reactors such as stirred tank and plug flow. Later on, real chemical process equipment and processes are modeled and simulated, using many of the techniques learned earlier. Programming languages such as Matlab and...

Objectives & Outcomes

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

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

Rules & Requirements

Prerequisites: E7 and CHM ENG 140

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

CHM ENG 150A Transport Processes 4 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
Principles of fluid mechanics and heat transfer with application to chemical processes. Laminar and turbulent flow in pipes and around submerged objects. Flow measurement. Heat conduction and convection; heat transfer coefficients.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

CHM ENG 150B Transport and Separation Processes 4 Units
Terms offered: Fall 2023, Fall 2022, Spring 2022
Principles of mass transfer with application to chemical processes. Diffusion and convection. Simultaneous heat and mass transfer; mass transfer coefficients. Design of staged and continuous separations processes.

Rules & Requirements

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.
CHM ENG 154 Chemical Engineering Laboratory 4 Units
Terms offered: Spring 2024, Fall 2023, Spring 2023
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: Spring 2024, Fall 2023, Spring 2023
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 multidisciplinary 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: Spring 2024, Fall 2023, Spring 2023
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 4 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170A, the first of a two-semester sequence will be on the upstream bioprocess of how to make products by designing unit operations and processes around living systems of cells.

Biochemical Engineering: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

Instructors: Zhang, Ryder

Biochemical Engineering: Read Less [-]

CHM ENG 170B Biochemical Engineering 4 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170B, the second of a two-semester sequence will be on the downstream bioprocess of recovery, separations and purification of bio-based products.

Biochemical Engineering: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

Instructors: Zhang, Ryder

Formerly known as: 170

Biochemical Engineering: Read Less [-]
CHM ENG C170L Biochemical Engineering Laboratory 3 Units
Terms offered: Spring 2024, Fall 2023, Spring 2023, Fall 2018, Spring 2014, Spring 2013
Laboratory techniques for the cultivation of microorganisms in batch and continuous reactions. Enzymatic conversion processes. Recovery of biological products.
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: Spring 2021, Fall 2018, Spring 2011
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.

Polymer Science and Technology: Read Less [-]

CHM ENG 167 Principles of Electrochemical Processes 3 Units
Terms offered: Spring 2024, Spring 2022, Spring 2021
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 2023, Fall 2021, Fall 2020, 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 per week

Additional Details
Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHEM C178
Polymer Science and Technology: Read Less [-]
**CHM ENG 179 Process Technology of Solid-State Materials Devices 3 Units**
Terms offered: Spring 2024, Spring 2023, Spring 2022
Chemical processing and properties of solid-state materials. Crystal growth and purification. Thin film technology. Application of chemical processing to the manufacture of semiconductors and solid-state devices.

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

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

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

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

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**CHM ENG 180 Chemical Engineering Economics 3 Units**
Terms offered: Fall 2023, Fall 2022, Fall 2020
Optimal design of chemical processes and unit operations, emphasizing the interactions between technical and economic considerations. Analysis of process risks. Chemical and biomolecular process design in the presence of uncertainties. Interest rate determinants and their effects on chemical process feasibility and choices. Relationships between structure and behavior of firms in the chemical processing industries. Multivariable input-output analyses.

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

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

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

**Chemical Engineering Economics: Read More [+]**

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**CHM ENG 182 Nanoscience and Engineering Biotechnology 3 Units**
Terms offered: Fall 2022, Fall 2021, Spring 2020
This nanoscale science and biomolecular engineering course will cover emerging topics in applied biotechnology and nanotechnology. Topics include enzyme kinetics, enzyme inhibition, recombinant protein generation, cell culture, genome editing, drug design, nanoparticle-based gene and drug delivery, fluorescence imaging, and sensors. The course will also probe the interface of biology with nanomaterials, and standard microscopic techniques to image biological structures and nanoscale materials.

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

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

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

**Instructor:** Landry

**Nanoscience and Engineering Biotechnology: Read Less [-]**
**CHM ENG 183 Climate Solutions Technologies 3 Units**

Terms offered: Fall 2020

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

**Course Objectives:**

- After taking this course, students should be able to discuss and explain to peers the role of CO2 in the earth’s climate, the greenhouse effect, the carbon cycle and how it relates to the fate of greenhouse gases on many time scales, and the role of fossil fuel combustion in the energy landscape and in CO2 emissions.
- Students in this class will gain experience in applying principles of systems thinking, engineering design and analysis to specific technologies that are relevant for mitigating climate change in the immediate future.
- Students will appreciate the critical role that communication plays in the path to implementation of solutions and will be comfortable engaging in a discussion about climate solutions with technical and non-technical peers.
- Students will gain a basic understanding of economics relative to climate policies, and of climate solutions currently being discussed by policymakers; they will gain an understanding of how these individual solutions fit into a global scheme.
- Students will gain knowledge about the most current technologies available for producing energy renewably, managing carbon, and reducing atmospheric greenhouse gas concentrations.

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

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

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

**Instructor:** Went

Climate Solutions Technologies: Read More [+]

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**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 [+]

**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 [-]

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

Terms offered: Spring 2024, Fall 2023, Spring 2023

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

**Research for Advanced Undergraduates:** Read More [+]

**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: Spring 2021, Spring 2020, Fall 2019

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

**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.

### 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.

**Hours & Format**

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

**Additional Details**

- **Subject/Course Level:** Chemical & Biomolecular Engineering/Undergraduate
- **Grading/Final exam status:** Letter grade. Final exam required.

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

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

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

**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.

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

Terms offered: Spring 2024, Spring 2023, Spring 2022

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: Spring 2024, Spring 2023, Fall 2022
Supervised research on a specific topic. Enrollment is restricted; see Introduction to Courses and Curricula section in the General Catalog.
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 [-]

**NUC ENG 10 What do nuclear engineers do? 1 Unit**

Terms offered: Fall 2023, Fall 2022
This seminar provides freshman and first year transfer students with an overview of the field of nuclear engineering (NE) and the research activities in the NE department. Every week a faculty member will introduce a topic and describe the main research challenges in that area.
What do nuclear engineers do?: Read More [+]

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

What do nuclear engineers do?: Read Less [-]

**NUC ENG 24 Freshman Seminars 1 Unit**

Terms offered: Spring 2024, Fall 2023, Spring 2023
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.

**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 To be decided by the instructor when the class is offered.

Freshman Seminars: Read Less [-]

**Nuclear Engineering**

Expand all course descriptions [+]
Collapse all course descriptions [-]
NUC ENG 100 Introduction to Nuclear Energy and Technology 3 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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 Energy and Technology:
Read More [+]

Rules & Requirements
Prerequisites: PHYSICS 7A, PHYSICS 7B, and MATH 53

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: Fratoni

Introduction to Nuclear Energy and Technology: Read Less [-]

NUC ENG 101 Nuclear Reactions and Radiation 4 Units
Terms offered: Fall 2023, Spring 2023, Spring 2022
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 [+]

Rules & Requirements
Prerequisites: PHYSICS 7C and NUC ENG 100

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 [+]

Rules & Requirements
Prerequisites: NUC ENG 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 2024, Fall 2022, Fall 2021
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: NUC ENG 101 or consent of instructor; NUC ENG 150 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: Spring 2024, Fall 2022, Fall 2020
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: NUC ENG 101 and NUC ENG 104  
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 2023, Fall 2022, Fall 2021  
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: MAT SCI 45 and one of the following: ENGIN 40, MEC ENG 40, or CHM ENG 141  
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: Fall 2022, Spring 2021, Spring 2020  
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: NUC ENG 100  
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 2024, Spring 2023, Spring 2022  
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: NUC ENG 101 (or similar background 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 C146 Radiochemical Methods in Nuclear Technology and Forensics 3 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
Experimental illustrations of the interrelation between chemical and nuclear science and technology and nuclear forensics; radioactive decay and counting techniques; nuclear spectroscopy; fundamental radiocchemical techniques; radiochemical separations techniques; tracers; activation analysis; forensic applications of radiochemistry; fusion, fission and nuclear reactors.
Radiochemical Methods in Nuclear Technology and Forensics: Read More [+]

Objectives & Outcomes
Course Objectives: Familiarize students with principles of nuclear and radiochemistry and its many important applications in our daily lives; provide hands-on training.
Student Learning Outcomes: A solid understanding of nuclear and radiochemistry; proficiency in safe handling of radioactive materials in the laboratory, and appreciation for the wide application of radiochemical techniques in chemistry, nuclear technology, and nuclear forensics.

Rules & Requirements
Prerequisites: CHEM 4B or CHEM 15; and CHEM 143 is recommended
Credit Restrictions: Students will receive no credit for CHEM 146 after completing CHEM 144, or CHEM C144.

NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
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: MATH 53, MATH 54, and NUC ENG 100

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 2022, Spring 2021, Fall 2019
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: MATH 53, MATH 54, and ENGIN 7

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: Fall 2023, Fall 2022, Fall 2021
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 required.
Instructor: Fratoni
Nuclear Criticality Safety: Read Less [-]

NUC ENG 161 Nuclear Power Engineering 4 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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 (MEC ENG 106 and MEC ENG 109; or CHM ENG 150A); Course in Thermodynamics (ENGIN 40, MEC ENG 40, or CHM ENG 141)
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 2024, Spring 2023, Spring 2022
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 2023, Fall 2021, Fall 2019
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.

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. Choose from the following:
CHM ENG 150A, CHM ENG 180, CIV ENG 111, CIV ENG 120, CIV ENG 152, CIV ENG 166, CIV ENG 175, ENGIN 120, IND ENG 166, IND ENG 172, MEC ENG 106, MEC ENG 109, MEC ENG C134 / EL ENG C128, MEC ENG 146, NUC ENG 120, NUC ENG 124, NUC ENG 150, and NUC ENG 161

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

NUC ENG 170A Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
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.

Course Objectives: * 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: Senior standing or consent of instructor

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

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.

Course Objectives: * 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: Senior standing

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

NUC ENG 170C Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
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.

Course Objectives: * 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: Senior standing

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

NUC ENG 170D Nuclear Design: Design in Nuclear Power Technology and Instrumentation 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.

Course Objectives: * 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: Senior standing

Fall and/or spring: 15 weeks - 3 hours of lecture per week
NUC ENG 175 Methods of Risk Analysis 3 Units
Terms offered: Fall 2022, Fall 2020, Fall 2018
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
Method of Risk Analysis: Read Less [-]

NUC ENG 180 Introduction to Controlled Fusion 3 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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 2023, Spring 2023, Summer 2022 10 Week Session
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.
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 2023, Spring 2023, Fall 2022
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 2023, Spring 2023, Fall 2022
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 [-]