



COLLEGE OF ENGINEERING | THE UNIVERSITY OF UTAH

---

*Department of Chemical Engineering*

**UNDERGRADUATE STUDENT GUIDE**

Tracey Farnsworth  
Academic Advisor  
Tel. 801-585-7175  
E-mail: [farnsworth@eng.utah.edu](mailto:farnsworth@eng.utah.edu)

Geoff Silcox  
Professor (Lecturing) and Associate Chair  
Tel. 801-581-8820  
E-mail: [geoff@che.utah.edu](mailto:geoff@che.utah.edu)

50 S Central Campus Drive RM 3290 MEB  
University of Utah, Salt Lake City, UT 84112-9203

Catalog Year 2011-2012

# **Table of Contents**

|  | Page      |
|--|-----------|
| <b><i>I. What is Chemical Engineering?</i></b> _____                             | <b>3</b>  |
| <b><i>II. Welcome and General Information</i></b> _____                          | <b>4</b>  |
| Mission _____  | 5         |
| Objectives _____   | 5         |
| <b><i>III. Admission Policy</i></b> _____  | <b>5</b>  |
| INTERMEDIATE STATUS _____  | 5         |
| MAJOR STATUS _____   | 6         |
| <b><i>IV. Students with Disabilities</i></b> _____                               | <b>6</b>  |
| <b><i>V. Degree Requirements</i></b> _____                                       | <b>7</b>  |
| Departmental Program of Study _____  | 8         |
| Undergraduate Seminar _____  | 12        |
| Emphasis in Energy Engineering _____   | 12        |
| Technical Electives _____  | 13        |
| Fundamentals of Engineering (FE) Exam _____                                      | 21        |
| <b><i>VI. Advanced Placement (AP) Credit</i></b> _____                           | <b>21</b> |
| <b><i>VII. Honors in Engineering Program</i></b> _____                           | <b>23</b> |
| <b><i>VIII. Transfer Students</i></b> _____                                      | <b>23</b> |
| <b><i>IX. CO-OP Program</i></b> _____  | <b>23</b> |
| <b><i>X. Policy on Repeating Courses</i></b> _____                               | <b>24</b> |
| <b><i>XI. Departmental Scholarships</i></b> _____                                | <b>24</b> |
| <b><i>XII. LEAP and E-LEAP Programs</i></b> _____                                | <b>24</b> |
| <b><i>XIII. Student Organizations</i></b> _____                                  | <b>25</b> |
| <b><i>XIV. Policy on Prerequisites</i></b> _____                                 | <b>25</b> |
| <b><i>XV. Combined BS/MS Program</i></b> _____                                   | <b>26</b> |
| <b><i>XVI. Undergraduate Courses offered in the Department (CH EN)</i></b> _____ | <b>28</b> |

## I. What is Chemical Engineering?

A chemical engineer applies chemical and engineering knowledge to several fields—environmental protection, pollution prevention, biotechnology, electronics, chemistry, petroleum, medicine, and law. Chemical engineers are involved in research, development (taking a process from bench scale to full scale), design and evaluation (how should the process work), plant design (how should the chemical plant be built), plant operation, sales, management, and academics.

Chemical engineers are responsible for making the probable possible. They have developed the synthetic rubber used for tires, translated laboratory breakthroughs in the drug industry to large-scale, low-cost production facilities, and changed daily life with the development of plastics and synthetic fabrics. Chemical engineers in the fertilizer industry are helping in the fight against world hunger. The chemical engineer is flexible, and possesses a fundamental background and a highly developed ability to analyze and solve new problems. This training and knowledge enable the chemical engineer to enter entirely new areas of research and development with success. The chemical engineering profession is moving into several exciting nontraditional areas that require engineers to have an even broader background in chemistry, mathematics, physics, and biology. These areas include biotechnology and biomedicine; electronic, photo optic, and recording materials and devices; and microstructured materials such as ceramics, polymers, and composites. Each of these specialties utilize chemical engineering principles and expertise to provide better health, improve the environment, develop more

efficient chemical production methods, and fabricate exciting new materials.

Every chemical engineer is an environmental engineer. Our graduates regularly deal with the environmental consequences of the production and use of chemical, biological, forest and food products, and of fuels and power. Many chemical engineers work in environmental control agencies and in consulting and control firms. Interested Chemical Engineering undergraduates may choose to specialize in environmental engineering and satisfy their B.S. Chemical Engineering elective requirements by taking fundamental courses in environmental engineering (see the section below on Technical Electives).

Unlimited opportunities for development of interests in either scientific or applied pursuits are offered in the chemical engineering field. Chemical engineers are vital players in improving our standard of living and initiating social change. Employment opportunities for our graduates are excellent, and salaries are among the highest for B.S. engineers.

## II. Welcome and General Information

It is our pleasure to welcome you to the University of Utah and to our Department. We hope that your first year will be an exciting and rewarding experience for you. This guide is designed to answer most of your questions regarding the policies and procedures of the University and the Department. We also recommend that you make an appointment with a student advisor in our department so that you can plan your education and understand the requirements in Chemical Engineering. Our student advisors are listed below.

|                   | <u>Advisor</u>    | <u>Telephone</u> | <u>E-mail</u>           |
|-------------------|-------------------|------------------|-------------------------|
| Primary Advisor   | Tracey Farnsworth | 585-7175         | farnsworth@eng.utah.edu |
| Auxiliary Advisor | Geoff Silcox      | 581-8820         | geoff@che.utah.edu      |

You can also find answers using the web sites listed below.

|                                    |   |
|------------------------------------|---|
| University of Utah                 | <a href="http://www.utah.edu">http://www.utah.edu</a>         |
| College of Engineering             | <a href="http://www.coe.utah.edu">http://www.coe.utah.edu</a> |
| Department of Chemical Engineering | <a href="http://www.che.utah.edu">http://www.che.utah.edu</a> |

The Bachelor of Science Degree in Chemical Engineering at the University of Utah is accredited. In the 2009-2010 accreditation cycle, the Chemical Engineering Program was granted the NGR (Next General Review) Status by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite, 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700.

There are many opportunities for the undergraduate student to interact directly with the faculty, both inside and outside of class. The department's faculty have diverse research interests, are internationally known for their engineering and scientific contributions, and many have extensive industrial experience. In addition, several members of the faculty have received the University's Distinguished Teaching Award.

Research is an important part of the department and offers the undergraduate student an opportunity to work individually with a professor on a specific engineering problem. This can be done as either a B.S. Senior Thesis or as part of the University's Undergraduate Research Program. Much of the research that is carried out in the department reflects the strengths of the broader industrial and academic community in Utah. Interests include combustion, polymer science, fluid flow, solid waste incineration, and biotechnology.

The department participates in several university research centers that enable students to collaborate with other students and professors throughout campus on interdisciplinary problems.

## **Mission**

The mission of the Department of Chemical Engineering is to foster the technical, critical thinking, and communication skills necessary for students and faculty to contribute to the engineering profession and to the well-being of society through excellence in teaching, research, and professional service.

## **Objectives**

The department and its constituencies have developed the following educational objectives. The objectives describe the career and professional accomplishments that the program is preparing graduates to achieve.

- 1) Graduates will contribute to their profession and succeed in their chosen careers.
- 2) Graduates will expand their knowledge and capabilities.
- 3) Graduates will be aware of issues that affect society and the world and will use this knowledge to strengthen their profession and contribute to the well-being of society.
- 4) Graduates will work effectively with others and practice ethical decision making.

## **III. Admission Policy**

All students are admitted to Chemical Engineering with pre-chemical engineering status and are encouraged to meet with a departmental advisor to review program requirements and to ensure understanding of what is needed to make satisfactory progress toward degree completion. Initial meetings with an advisor often occur as part of the University's orientation program. The program requirements are summarized in our Undergraduate Handbook that is available on the web (<http://www.che.utah.edu/geoff/FROSHGUIDE00c.pdf>) and in hardcopy.

After completion of first year courses, students apply for **Intermediate Status** via online application. Intermediate Status is required before students can apply for **Major Status**. Major Status is required before students take their third and fourth year engineering classes.

### **INTERMEDIATE STATUS**

A student may apply for intermediate status after the following courses have been completed:

- CHEM 1210 and 1215 (General Chemistry I and lab)
- MATH 1210 (Calculus I)

In addition, applicants must have completed or be currently enrolled in the following courses.

- CHEM 1220 and 1225 (General Chemistry II and lab)
- MATH 1220 (Calculus II)
- CH EN 1703 (Intro. to Chemical Engineering) or CS 1000 or 1001
- CH EN 4753 or 4755 (Undergraduate Seminar)
- PHYS 2210 (Physics for Scientists and Engineers I)
- WRTG 2010 (lower-division writing requirement)

Admission to intermediate status requires an overall GPA of at least 2.5 in the above courses, with no individual grade below a C- being accepted, except for math courses where the minimum acceptable grade is C. The department may count AP credit for some of these courses if appropriate scores are obtained (see Section V). Transfer students who wish to be admitted to intermediate status, and who did not graduate from a State of Utah institution, must complete a Transfer Agreement ([http://www.che.utah.edu/~geoff/transfer\\_agre.xls](http://www.che.utah.edu/~geoff/transfer_agre.xls)) and meet with an advisor before they can apply. The advisor must approve all of the transfer credit by signing the Transfer Agreement.

You may apply for intermediate status online at <http://www.che.utah.edu>. Please go to the undergraduate page and select Forms and Applications.

### **MAJOR STATUS**

In order to be admitted to major status, students must have been admitted to intermediate status. Admission to major status requires an overall GPA of 2.5, with no individual grade below a C- being accepted, in the following required chemical engineering course work:

- CH EN 2450 (Numerical Methods)
- CH EN 2300 (Thermodynamics I)
- CH EN 2800 (Process Engineering)

You may apply for major status online at <http://www.che.utah.edu>. Please go to the undergraduate page and select Forms and Applications.

Once admitted, to retain major status students must maintain a minimum cumulative GPA of 2.0 in required chemical engineering courses. Transfer GPA is not combined with U of U GPA for this 2.0 requirement. All required courses must be taken for a letter grade. Students are permitted to register no more than twice for any engineering course; those receiving grades of W or I, in addition to other grades, are considered as having been registered.

Students who complete their sophomore year at the U of U will normally apply for major status at the end of that year, by which time they will have completed the required courses. Transfer students who wish to be admitted to major status must first complete a Transfer Agreement ([http://www.che.utah.edu/~geoff/transfer\\_agre.xls](http://www.che.utah.edu/~geoff/transfer_agre.xls)) and meet with an advisor before they can apply. The advisor must approve all of the transfer credit by signing the Transfer Agreement.

### **IV. Students with Disabilities**

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the Chemical Engineering Program, reasonable prior notice needs to be given to the Center for Disability Services (CDS), <http://disability.utah.edu/>, 162 Olpin Union Building, 581-5020. CDS will work with you and your instructors to make arrangements for accommodations. All written information in your courses can be made available in alternative format with prior notification to the Center for Disability Services.

## V. Degree Requirements

In order for a student to obtain a B.S. degree in chemical engineering from our department he or she must satisfy both the University-wide degree requirements **and** the Departmental degree requirements. The University of Utah degree requirements are stated in the *General Catalog*. Many of these requirements are fulfilled through the department requirements. The department requirements are listed below and many of these are explained in detail in the following sections.

1. Completion of the course requirements listed under the departmental program of study below that includes the minimum number of undergraduate Seminar courses (4) and the required technical elective credits (17).
2. A minimum of 122 semester hours is required for a bachelor's degree of which 40 must be 3000 level or above. The program of study for a B.S. degree in Chemical Engineering requires 130 semester hours with well over 40 semester hours in the 3000 level or above category.
3. Satisfactorily completing the General Education and Bachelor's Degree Requirements for the University. The University has a Lower Division Writing requirement that is normally filled by completing Writing 2010 with a grade of C- or better, and an Upper-Division Communications/Writing requirement, which is normally filled by completing CH EN 4905. The Quantitative Reasoning requirement (QA and QB) can be satisfied with Calculus. The two B.S. Quantitative Intensive classes (QI) are normally filled by completing the required Chemical Engineering and Chemistry classes. Students are responsible for fulfilling the Diversity requirement, the American Institutions requirements, the Intellectual Explorations requirements, and the International Requirement. Chemical Engineering students can fulfill a General Education Humanities Exploration requirement and a technical elective requirement by completing PHIL 4540, Engineering, Ethics, and Society. There are three classes that will fulfill both the International Requirement and a technical elective requirement.
4. Meeting the University's residency requirement, that is, of the total hours for graduation, at least 30 must be earned in courses taken in residence at the University (correspondence courses, courses earned by exam or petition do not count). Twenty of the student's last 30 hours must be earned in residence at the University.
5. Degree candidates must have a minimum cumulative GPA of 2.0 in required chemical engineering courses. Transfer GPA is not combined with U of U GPA for this requirement. All required courses must be taken for letter grades.
6. The minimum acceptable grade in required chemical engineering classes is C- and this policy applies to transfer credit if the transferred course is equivalent to a required chemical engineering course at the University of Utah. Required courses with grades below C- will not be accepted toward graduation. This policy does not apply to technical electives for which the minimum acceptable grade is D-.
7. In order to graduate, students must pass the morning (general engineering) and afternoon (chemical engineering) sessions of the Fundamentals of Engineering (FE) Exam. The exam is administered by the State and is nationally composed and graded. This exam is given twice yearly and should be taken at the earliest possible

date in the senior year or in April of the junior year. Students who do not pass the FE exam after two attempts are permitted to petition the Undergraduate Committee for an exception to policy. For more information on the petition process, see the section entitled, Fundamentals of Engineering Exam.

***Departmental Program of Study***

The Departmental Four Year Program of Study is listed on page 9. Although some students are able to complete the necessary course work in four years, some of our students do not, primarily because of other commitments, such as family and work. We have included a Five Year Program as a guide for those students on page 10. To avoid unnecessary loss of time, the student should make sure the prerequisites indicated under course descriptions in the University General Catalog are completed prior to the time the courses are taken. Courses taken without the stated prerequisites may not meet graduation requirements. Note that the minimum acceptable grade in required chemical engineering courses is C-.



## FOUR-YEAR PROGRAM IN CHEMICAL ENGINEERING

### FIRST YEAR

#### FALL SEMESTER

MATH 1210 or 1270 Calculus I<sup>1</sup> (4)  
CHEM 1210 General Chemistry I (4)  
CHEM 1215 General Chemistry Lab I (1)  
WRTG 2010 Intermediate Writing (3)  
CH EN 1703 Intro to ChE (2)  
General Education (3)

TOTAL HOURS: 17

#### SPRING SEMESTER

MATH 1220 or 1280 Calculus II<sup>1</sup> (4)  
CHEM 1220 General Chemistry II<sup>2</sup> (4)  
CHEM 1225 General Chemistry Lab II (1)  
PHYS 2210 Phycs For Scien & Eng I (4)  
CH EN 4755 Undergraduate Seminar (0.5)  
General Education (3)

TOTAL HOURS: 16.5

### SECOND YEAR

#### FALL SEMESTER

MATH 2250 Diff Equ & Lin Algebra (4)  
ME EN 1300 Statics and Strength of Matls (4)  
PHYS 2220 Phycs For Scien & Eng II (4)  
PHYS 1809 General Physics Laboratory (1)  
CH EN 2450 Numerical Methods (2)  
General Education (3)

TOTAL HOURS: 18

#### SPRING SEMESTER

MATH Technical Elective<sup>3</sup> (Math) (2 to 4)  
CH EN 2300 Thermodynamics I (2)  
CH EN 2800 Fund. of Process Engineering (3)  
CHEM 2310 Organic Chemistry I<sup>4</sup> (4)  
CHEM 2315 Organic Chemistry lab I<sup>4</sup> (1)  
CH EN 4755 Undergraduate Seminar (0.5)  
General Education (3)

TOTAL HOURS: 17.5

### THIRD YEAR

#### FALL SEMESTER

CHEM 3060 Quantum Chem (4)  
CH EN 3353 Fluid Mechanics (3)  
CH EN 3453 Heat Transfer (3)  
CH EN 3853 Chemical Eng Thermo (3)  
CH EN 4753 Undergraduate Seminar (0.5)  
Technical Elective<sup>3</sup> (3)

TOTAL HOURS: 16.5

#### SPRING SEMESTER

CH EN 3603 Mass Transfer & Separations (3)  
CH EN 3553 Chemical Reaction Eng (3)  
CH EN 5103 Biochemical Engineering (3)  
Technical Electives<sup>3</sup> (4)  
General Education/Bachelor Degree Requir. (3)

TOTAL HOURS: 16

### FOURTH YEAR

#### FALL SEMESTER

CH EN 4903 Projects Laboratory I (4)  
CH EN 4253 Process Design I (3)  
CH EN 4203 Process Control (3)  
CH EN 4753 Undergraduate Seminar (0.5)  
Technical Elective<sup>3</sup> (3)  
General Education (3)

TOTAL HOURS: 16.5

#### SPRING SEMESTER

CH EN 4905 Projects Laboratory II<sup>5</sup> (3)  
CH EN 5253 Process Design II (3)  
Technical Elective<sup>3</sup> (3)  
General Education (3)

TOTAL HOURS: 12

GRAND TOTAL HOURS: 130

1. Students with adequate math preparation are encouraged to take the MATH 1270 and 1280, Accelerated Engineering Calculus series, in place of MATH 1210 and 1220. Students who take 1210/1220 are encouraged to take MATH 2210 as a technical elective. The Mathematics Department requires a minimum grade of C in all math courses in order for them to serve as prerequisites for subsequent math courses.

2. Students who qualify should take CHEM 1221, Honors General Chemistry II and CHEM 1241, Honors General Chemistry Lab II, instead of CHEM 1220, General Chemistry II, and CHEM 1225, General Chemistry Lab II.

3. A total of 17 credit hours of technical elective courses are required.

4. Students who qualify should take CHEM 2311, Honors Organic Chemistry I, instead of CHEM 2310.

5. CH EN 4905 fulfills the Upper-division Writing/Communication requirement.

## FIVE-YEAR PROGRAM IN CHEMICAL ENGINEERING

### FIRST YEAR

#### FALL SEMESTER

MATH 1210 or 1270 Calculus I<sup>1</sup> (4)  
CHEM 1210 General Chemistry I (4)  
CHEM 1215 General Chemistry Lab I (1)  
WRTG 2010 Intermediate Writing (3)  
CH EN 1703 Intro to ChE (2)  
TOTAL HOURS: 14

#### SPRING SEMESTER

MATH 1220 or 1280 Calculus II<sup>1</sup> (4)  
CHEM 1220 General Chemistry II<sup>2</sup> (4)  
CHEM 1225 General Chemistry Lab II (1)  
PHYS 2210 Phycs For Scien & Eng I (4)  
CH EN 4755 Undergraduate Seminar (0.5)  
TOTAL HOURS: 13.5

### SECOND YEAR

#### FALL SEMESTER

MATH 2250 Diff Equ & Lin Algebra (4)  
ME EN 1300 Statics and Strength of Matls (4)  
PHYS 2220 Phycs For Scien & Eng II (4)  
PHYS 1809 General Physics Laboratory (1)  
CH EN 2450 Numerical Methods (2)

TOTAL HOURS: 15

#### SPRING SEMESTER

CH EN 2300 Thermodynamics I (2)  
CH EN 2800 Fund. of Process Engineering (3)  
CHEM 2310 Organic Chemistry I<sup>3</sup> (4)  
CHEM 2315 Organic Chemistry lab I<sup>3</sup> (1)  
CH EN 4755 Undergraduate Seminar (0.5)  
General Education (3)

TOTAL HOURS: 13.5

### THIRD YEAR

#### FALL SEMESTER

CHEM 3060 Quantum Chem (4)  
CH EN 3353 Fluid Mechanics (3)  
General Education (3)  
CH EN 3853 Chemical Eng Thermo (3)  
TOTAL HOURS: 13

#### SPRING SEMESTER

MATH Technical Elective<sup>4</sup> (Math) (2-4)  
General Education/Bachelor Degree Requir. (6)  
Technical Elective<sup>4</sup> (4)

TOTAL HOURS: 14

### FOURTH YEAR

#### FALL SEMESTER

CH EN 3453 Heat Transfer (3)  
Technical Elective<sup>4</sup> (6)  
CH EN 4753 Undergraduate Seminar (0.5)  
General Education (3)  
TOTAL HOURS: 12.5

#### SPRING SEMESTER

CH EN 3553 Chemical Reaction Eng (3)  
CH EN 3603 Mass Transfer & Separations (3)  
CH EN 5103 Biochemical Engineering (3)  
General Education (3)  
TOTAL HOURS: 12

### FIFTH YEAR

#### FALL SEMESTER

CH EN 4903 Projects Laboratory I (4)  
CH EN 4203 Process Control (3)  
CH EN 4253 Process Design I (3)  
CH EN 4753 Undergraduate Seminar (0.5)  
TOTAL HOURS: 10.5<sup>6</sup>

#### SPRING SEMESTER

CH EN 4905 Projects Laboratory II<sup>5</sup> (3)  
CH EN 5253 Process Design II (3)  
Technical Elective<sup>4</sup> (3)  
General Education (3)  
TOTAL HOURS: 12

GRAND TOTAL HOURS: 130

1. Students with adequate math preparation are encouraged to take the MATH 1270 and 1280, Accelerated Engineering Calculus series, in place of MATH 1210 and 1220. Students who take 1210/1220 are encouraged to take MATH 2210 as a technical elective. The Mathematics Department requires a minimum grade of C in all math courses in order for them to serve as prerequisites for subsequent math courses.

2. Students who qualify should take CHEM 1221, Honors General Chemistry II and CHEM 1241, Honors General Chemistry Lab II, instead of CHEM 1220, General Chemistry II, and CHEM 1225, General Chemistry Lab II.

3. Students who qualify should take CHEM 2311, Honors Organic Chemistry I, instead of CHEM 2310.

4. A total of 17 credit hours of technical elective courses are required.

5. CH EN 4905 fulfills the Upper-division Writing/Communication requirement.

6. Note that a student must take at least 12 credit hours to be considered a full-time student, a requirement for scholarship recipients. You may have to take an additional course to bring your total credit hours up to 12 for this semester.

Some factors to be considered in planning your course work are

- Most courses have prerequisites. Figure 1 shows how the required courses in the four-year program of study depend on each other. The Department's policy on prerequisites is given on page 24 of this guide.
- Chemistry 1220 and 1225 and Physics 2210 are prerequisites to Chemical Engineering 2800. Chemical Engineering 2300 is a co-requisite.
- Upper-division (3000 and above) chemical engineering courses are offered only once each year and are restricted to students who have satisfied the prerequisites.
- Students who do not achieve a grade of C or better in prerequisite courses seldom develop satisfactorily in the subsequent courses.

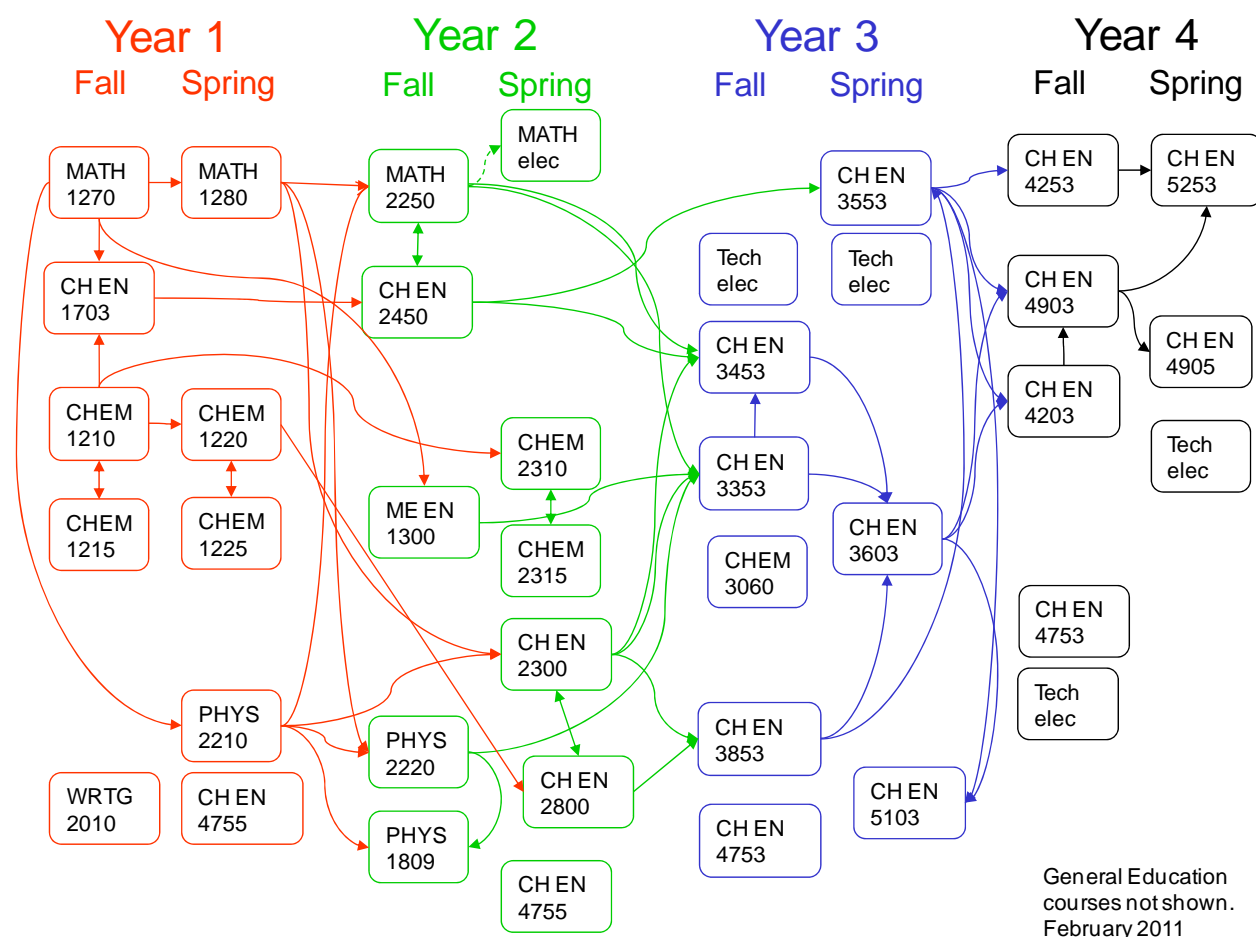


Figure 1. Flow chart showing how the required courses depend on each other. Arrows indicate the existence of a co-requisite or prerequisite or recommended prerequisite.

### ***Undergraduate Seminar***

All chemical engineering candidates must take at least 2.0 credit hours of undergraduate seminar (CH EN 4753, 4755 - 0.5 credit hours each) during their tenure. This seminar course, which is offered every semester for 0.5 credit hours, meets once a week and is designed to discuss topics in chemical engineering. It is usually organized by undergraduate students and provides useful information about the chemical engineering profession, employment opportunities, student organizations, as well as conducting tours in the area. Students are encouraged to sign up for the appropriate course each semester if it doesn't conflict with other courses.

### ***Emphasis in Energy Engineering***

Three of the major challenges facing humanity are limitations in the supplies of food, water, and energy. The emphasis in energy engineering is meant to give undergraduates in Chemical Engineering a suite of technical electives that will equip them with the engineering and professional skills required to address the need for clean and secure energy. Environmental protection, energy use, and energy production are included in the emphasis. The emphasis will appear on students' transcripts.

The emphasis requires 15 units and this requirement fits within the current requirement of 17 hours of technical electives in Chemical Engineering. The core electives are listed below. Students will complete 9 units from these six courses.

| <b>Core Classes for Emphasis in Energy Engineering (9 units required)</b> |                                   |       |
|---|-----------------------------------|-------|
| Course  | Title                             | Units |
| CH EN 5153  | Fundamentals of Combustion        | 3     |
| CH EN 5155  | Reservoir Engineering             | 3     |
| CH EN 5157  | Production Engineering I          | 1.5   |
| CH EN 5159  | Production Engineering II         | 1.5   |
| CH EN 5305  | Air Pollution Control Engineering | 3     |
| CH EN 5307  | Green Engineering                 | 3     |

Students will complete 6 units of supporting courses that provide a broad overview of energy related topics including climate change, sustainability, geology, ethics, and statistics. The supporting courses also include nuclear engineering and the design of thermal systems for power plants.

| <b>Supporting Classes for Emphasis in Energy Engineering (6 units required)</b> |   |       |             |
|---|---|-------|-------------|
| Course  | Title   | Units | Comments    |
| ATMOS 5400  | The Climate System                                      | 3     |             |
| ECE 2210  | Electrical and Computer Engineering for Non-majors      | 3     |             |
| ECE 3600  | Introduction to Electric Power Engineering              | 3     |             |
| GEO 5220  | Seismology II: Exploration and Engineering Seismology   | 3     |             |
| GEO 5240  | Physical Fields II: Electrical Methods                  | 3     |             |
| GEO 5260  | Petrophysics and Well Logging                           | 2     |             |
| GEO 5370  | Contaminant Partitioning for Scientists & Engineers     | 3     |             |
| GEO 5390  | Solute Transport and Subsurface Remediation             | 3     |             |
| GEO 5690  | Aqueous Geochemistry for Engineers & Scientists         | 3     |             |
| GEO 5760  | Stratigraphy and Sedimentary Processes                  | 4     |             |
| GEO 5920  | Fundamentals of Applied Earth Science                   | 1.5   |             |
| MATH 3070   | Applied Statistics                                      | 4     |             |
| MATH 3090   | Design of Experiments                                   | 3     |             |
| MATH 3150   | Partial Differential Equations for Engineering Students | 2     |             |
| MATH 5600   | Survey of Numerical Methods                             | 4     |             |
| ME EN 5800  | Sustainable Energy Engineering                          | 3     |             |
| ME EN 5810  | Thermal Systems Design                                  | 3     |             |
| NUCL 3000   | Nuclear Principles in Engineering and Science           | 3     |             |
| NUCL 4000   | Nuclear Engineering and Science Using the TRIGA         | 3     |             |
| NUCL 5100   | Reactor Physics   | 3     |             |
| PHYS 3150   | Energy and Sustainability: A Global Perspective         | 3     | Fulfills IR |

### **Technical Electives**

Bachelor's degree candidates must complete 17 hours of approved technical electives. At least two of the 17 hours must be an upper division math class taught by the math department (MATH) and at least nine of the 17 hours must be upper division chemical engineering classes (CH EN) or approved upper division nuclear engineering classes (NUCL). Table I lists the approved classes for technical electives. More than one math class can be taken. **Although not required, students may choose to take most of their electives in one particular emphasis area.** Approved courses, listed by emphasis areas, are given in Table II. A brief description of the various emphasis areas is given in Table III. A student needs to petition the faculty, through the Undergraduate

Committee (contact the Chair, Geoff Silcox), if she or he wants to use a course not listed in Tables I and II as a technical elective. Students are responsible for completing any prerequisites or co-requisites for technical elective classes.

Students who are interested in biochemical engineering and living systems are allowed to petition the Undergraduate Committee (contact the Chair, Geoff Silcox) for an exception to the above policy. The petition process allows up to 6 of the required CH EN hours to be replaced by other approved electives.

**Table I. Approved classes for technical electives.  
At least two elective hours must be upper division math.**

| <u>Course</u> | <u>Title</u>                   | <u>Semester Hours</u> | <u>Prerequisite(s)</u>                   |
|---------------|--------------------------------|-----------------------|--|
| MATH 3070     | Applied Statistics I           | 4                     | MATH 1220, 1250, or 1270                 |
| MATH 3080     | Applied Statistics II          | 3                     | MATH 3070                                |
| MATH 3090     | Design of Experiments          | 3                     | MATH 3070                                |
| MATH 3150     | Partial Differential Equations | 2                     | MATH 2250 and either 1260 (1280) or 2210 |
| MATH 3160     | Complex Variables              | 2                     | MATH 2250                                |
| MATH 5600     | Survey of Numerical Analysis   | 4                     | MATH 2210, 2250                          |
| MATH 5620     | Intro to Numerical Analysis II | 4                     | MATH 5610                                |

**At least nine hours must be upper division CH EN or approved NUCL classes\***

| <u>Course</u> | <u>Title</u>                      | <u>Semester Hours</u> | <u>Prerequisite(s)</u>  |
|---------------|-----------------------------------|-----------------------|---|
| CH EN 4973    | Undergraduate Thesis              | 1 - 3                 | Instructor's consent  |
| CH EN 4975    | Chemical Engineering Clinic       | 1 - 3                 |   |
| CH EN 4977**  | Co-op                             | 1 - 3                 | Instructor's consent<br>Up to 3 hours as upper division CH EN |
| CH EN 5153    | Fundamentals of Combustion        | 3                     | Instructor's consent  |
| CH EN 5155    | Reservoir Engineering             | 3                     | Instructor's consent  |
| CH EN 5157/9  | Production Engineering I/II       | 1.5/1.5               | Instructor's consent  |
| CH EN 5203    | State Space Methods               | 3                     | CH EN 4203  |
| CH EN 5305    | Air Pollution Control Engineering | 3                     | Major status  |
| CH EN 5307    | Green Engineering                 | 3                     | Instructor's consent  |

|              |   |       |   |
|--------------|---|-------|---|
| CH EN 5950   | Independent Study                           | 1 – 5 | Instructor's consent                              |
| CH EN 5960   | Special Topics                              | 3     | Instructor's consent                              |
| NUCL 3000*** | Nuclear Principles in Engineering & Science | 3     | Calculus I & II, first year chemistry and physics |
| NUCL 3100    | Introduction to Neutron-Based Engineering   | 3     | NUCL 3000   |
| NUCL 3200    | Radiochemistry with Laboratory I            | 3     | First year chemistry and physics courses          |
| NUCL 4000    | Nuclear Engineering & Science Using TRIGA   | 3     | NUCL 3000, 3100                                   |

\*Students who are interested in biochemical engineering and living systems are allowed to petition the Undergraduate Committee (contact the Chair, Geoff Silcox) for an exception to this policy. The petition process allows up to 6 of the required CH EN hours to be replaced by other approved electives in the biochemical or living systems areas.

\*\*Students who register for CH EN 4977 can receive up to 3 units of chemical engineering elective credit. Students who register for CH EN 4978 can receive up to 3 units of non-departmental elective credit. The total credit hours awarded to 4977 and 4978 cannot exceed 6 units.

\*\*\*A minor in Nuclear Engineering is available. See <http://www.nuclear.utah.edu/minor.html>.

#### Other approved technical elective classes

| <u>Course</u> | <u>Title</u>                         | <u>Semester Hours</u> | <u>Prerequisite(s)</u>                                   |
|---------------|--------------------------------------|-----------------------|--|
| BIOL 2020     | Principles of Cell Biology           | 3                     | BIOL 1210 and 2010, CHEM 1210                            |
| BIOL 2030     | Genetics                             | 3                     | BIOL 2020  |
| BIOL 3510     | Biological Chem I                    | 3                     | BIOL 2020 and 2030, CHEM 2320                            |
| BIOL 3520     | Biological Chem II                   | 3                     | BIOL 3510 or CHEM 3510                                   |
| BIOL 5495     | Biophysical Ecology                  | 4                     | BIOL 2010, CHEM 1220, MATH 1220, PHYS 2210               |
| CHEM 2320     | Organic Chemistry II                 | 4                     | CHEM 2310<br><i>May take CHEM 2320 or 2321, not both</i> |
| CHEM 2321     | Honors Organic Chemistry II          | 4                     | CHEM 2311<br><i>May take CHEM 2320 or 2321, not both</i> |
| CHEM 2325     | Organic Chemistry Laboratory II      | 1                     | Co-requisite CHEM 2320 or 2321                           |
| CHEM 3070     | Thermodynamics and Chemical Kinetics | 4                     | MATH 2210, PHYS 2220 and CHEM 1220 or 1221               |
| CHEM 3090     | Biophysical Chemistry                | 3                     | MATH 2210 and PHYS 2220 and CHEM 1220 or 1221            |
| CHEM 3100     | Inorganic Chemistry                  | 5                     | CHEM 1220  |
| CHEM 5720     | Adv. Physical Chemistry Lab          | 2                     | CHEM 3060  |

|             |                                   |       |   |
|-------------|-----------------------------------|-------|---|
| CHEM 5730   | Adv. Inorganic Chemistry Lab      | 2     |   |
| CH EN 4978* | Co-op                             | 1 – 3 | Instructors consent<br><i>Up to 3 hours as non-ChE elective*</i>          |
| CVEEN 3610  | Intro. to Environ. Engineering I  | 3     | CHEM 1220, CH EN 3353   |
| CVEEN 5605  | Environmental II                  | 3     | CVEEN 3610  |
| ECON 3500   | International Economics           | 3     | ECON 2010 and 2020 (or ECON 1010 and instructor's consent) Fulfills IR    |
| GEO 5350    | Groundwater                       | 3     | MATH 1220   |
| MATH 2210   | Calculus III                      | 3     | MATH 1220 <i>(can not be used if student completed MATH 1260 or 1280)</i> |
| ME EN 5000  | Engineering Law and Contracts     | 3     | Major Status  |
| MET E 5260  | Physical Metallurgy I             | 3     |   |
| METEO 5210  | Physical Meteorology              | 3     | Instructor consent  |
| MGT 3410    | Business Law: The Commercial Env. | 3     |   |
| MGT 3500    | Principles of Management          | 3     |   |
| MGT 3680    | Human Behavior in Organizations   | 3     |   |
| MGT 3700    | Fundamentals of Entrepreneurship  | 3     |   |
| MGT 4560    | Small Business Management         | 3     |   |
| MGT 4900    | International Management          | 3     | Fulfills IR   |
| MGT 5510    | Human Resource Management         | 3     |   |
| MGT 5770    | Business Plan Development         | 3     |   |
| MGT 5780    | New Venture Implementation        | 3     |   |
| MKTG 4840   | International Marketing           | 3     | MKTG 3010 or 3011. Fulfills IR.   |
| MSE 3061    | Transport Phenomena in MSE        | 3     | Major Status in ChE   |
| MSE 3210    | Electronic Properties of Solids   | 3     | Major Status in ChE   |
| MSE 3310    | Introduction to Ceramics          | 3     |   |



|            |   |   |  |
|------------|---|---|--|
| MSE 3410   | Intro to Polymers                               | 3 |  |
| MSE 5040   | Intro to Modern Biomaterials                    | 4 |  |
| MSE 5475   | Introduction to Composites                      | 3 |  |
| PHIL 4540  | Engineering, Ethics, and Society*               | 3 | <i>Counts as both a technical elective and a general education course.</i>                     |
| PHYS 2215  | Physics Lab for Scientists & Eng. I             | 1 | PHYS 2210  |
| PHYS 2225  | Physics Lab for Scientists & Eng. II            | 1 | PHYS 2210 and 2215<br><i>Both PHYS 2215 &amp; 2225 can be used as substitute for PHYS 1809</i> |
| PHYS 3150  | Energy and Sustainability: a Global Perspective | 3 | PHYS 2010 or 2020 and Math 1210. Fulfills International Requirement                            |
| PHYS 3610  | Electronics for Instrumentation                 | 3 | PHYS 2220 and 2225   |
| PHYS 3740  | Intro. to Quantum Theory & Relativity           | 3 | PHYS 2220, MATH 2250   |
| PHYS 3760  | Principles of Thermo. & Mech.                   | 3 |  |
| POL S 3320 | Intro. to Public Policy & Analysis              | 3 |  |
| POL S 4790 | The United States Constitution                  | 3 | <i>May take POL S 4790 or 5211, not both</i>   |
| POL S 5211 | Constitutional Law                              | 3 | <i>May take POL S 4790 or 5211, not both</i>   |
| POL S 5322 | Environ. Policy                                 | 3 | <i>May take POL S 5322 or URBPL 5350, not both</i>   |
| URBPL 5350 | Public Lands and Environ. Policy                | 3 | <i>May take POL S 5322 or URBPL 5350, not both</i>   |
| URBPL 5360 | Environ. Planning Law & Policy                  | 3 |  |

\* PHIL 4540 is being taught infrequently and may not be available.

**Table II. List of Approved Courses for Technical Electives by Area**

| <b>Area</b>                                | <b>Recommended Courses</b>  | <b>Additional Approved Courses</b>   |
|--|---|--|
| Process Control                            | CH EN 5203  | CH EN 4973, 4975, 4977, 4978<br>PHYS 2215, 2225, 3610<br>MATH 3070, 3080, 3150, 5600   |
| Emphasis in Energy Engineering             | CH EN 5153, 5155, 5157, 5159, 5305, 5307                                | CH EN 4973, 4975, 4977, 4978, 5203, 5305<br>MATH 3150 plus supporting classes for Emphasis in Energy Engineering   |
| Applied Mathematics and Physical Sciences  | BIOL 2020<br>CHEM 2320, 2325, 3100, 5720, 5730<br>PHYS 3610, 3740, 3760 | CH EN 4973, 4975, 4977, 4978, 5203<br>MATH 3070, 3080, 3090, 3150, 3160, 5620  |
| Biochemical Engineering and Living Systems | BIOL 2020   | BIOL 2030, 3510, 3520<br>CHEM 2320, 2325, 3100, 3090<br>CH EN 4973, 4975, 4977, 4978<br>MATH 3150<br>MSE 5040<br>PHYS 3610   |
| Environmental Engineering                  | CH EN 5305, 5307  | BIOL 2020<br>CH EN 4973, 4975, 4977, 4978<br>CVEEN 3610, 5605<br>GEO 5350<br>MATH 3150, 3070<br>METEO 5210<br>PHYS 3610  |
| Management, Policy, and Law                | CH EN 5305, 5307  | CH EN 4973, 4975, 4977, 4978<br>ECON 3500<br>MATH 3070, 3150, 3160<br>ME EN 5000<br>MGT 3410, 3500, 3700, 3680, 4560, 4900, 5510, 5770, 5780<br>MKTG 4840<br>PHIL 4540 <sup>θ</sup><br>PHYS 3610<br>POL S 3320, 4790*, 5211*, 5322**<br>URBPL 5360, 5350** |
| Materials and Nuclear                      | MSE 3210, 3410<br>NUCL 3000, 3100, 3200, 4000                           | CH EN 4973, 4975, 4977, 4978, 5655<br>MATH 3070, 3150, 3160<br>MET E 5260<br>MSE 3061, 3210, 3310, 3410, 5040, 5475<br>PHYS 3610, 3620   |

\* Students may take one of POL S 4790 or 5211 not both.

\*\* Students may take one of POL S 5322 or URBPL 5350, not both.

<sup>θ</sup> PHIL 4540 counts as both a technical elective and a general education course; however, it is being taught infrequently.

**Table III. BRIEF DESCRIPTION OF THE VARIOUS AREAS FOR TECHNICAL ELECTIVES WITHIN THE DEPARTMENT OF CHEMICAL ENGINEERING**

**Applied Math and Physical Sciences:**

The Applied Mathematics and Physical Sciences option is intended to provide students with deep understanding in fundamental sciences; mathematics, physics, chemistry and biology. Students intending to pursue graduate school options may want to consider courses in mathematics to buildup their applied mathematics background. Students wanting to go to medical school may want to consider additional courses in biology and biological chemistry. Students wanting to complete the science and math series required of them in the basic curriculum may also choose this area.

**Biochemical Engineering and Living Systems:**

With recent developments in biotechnology and genetics, it is apparent that chemical engineers will be needed in the future to design and develop systems that will produce biochemical/biomedical products more efficiently and economically. The objective of this emphasis area is to give the student an opportunity to learn more about biological systems and how chemical engineering principles are applied in biotechnology. Applications range from the biomedical field to bioprocessing to bioremediation. The required course, CH EN 5103, gives the student an introduction to biochemical engineering. The Projects Labs, 4903 and 4905, include projects where the student will perform biological and biochemical experiments. Biology 2020 is strongly recommended to provide background on cell structure and other biological basics and is a prerequisite to CH EN 5103.

**Environmental Engineering:**

The courses listed for this area were selected for students with a strong interest in the environmental area. The courses are designed to give the student more, in depth, information on the wide-range of environmental subjects. Topics covered include environmental aspects of fuels, air pollution, bioremediation, groundwater flow as well as introductory courses in environmental engineering.

**Energy Engineering:**

Three of the major challenges facing humanity are limitations in the supplies of food, water, and energy. The emphasis in energy engineering is meant to give undergraduates in Chemical Engineering a suite of technical electives that will equip them with the engineering and professional skills required to address the need for clean and secure energy. Environmental protection, energy use, and energy production are included in the emphasis. The emphasis will appear on students' transcripts.

**Management, Policy, and Law:**

Engineers frequently encounter challenges in scientific, legal, administrative, and public policy areas. The logical problem solving skills inherent in engineering lend themselves to good approaches to management, policy, and law. This option allows the student to build the skills necessary to develop and manage their own projects. Specifically, this curriculum includes course work in strategic planning, statistical quality control, and financial modeling. The suggested curriculum also includes classes that explore public policy, law, engineering ethics, and the allocation of human resources. Engineering students who complete this option will enter their first job knowing that it takes more than just science and mathematics to complete successfully any project.

**Materials and Nuclear:**

The Materials and Nuclear option provides students interested in engineering and/or nuclear materials an opportunity to explore these important areas of chemical engineering. Courses expose students to the fundamentals of materials properties as well as engineering application of materials, including metals, ceramics, polymers, electronic, and composite materials. Emphasis is placed on chemical engineering aspects of materials processing as well as materials properties and selection for applications in chemical engineering. A minor in Nuclear Engineering is available; see <http://www.nuclear.utah.edu/minor.html>.

**Process Control:**

Today, process engineers have software and hardware capabilities to implement multivariable model-based control, and to build accurate empirical and semi-empirical models, perform process optimization, fault detection, process monitoring, etc. The limiting factor in a wide-spread application of the advanced process control and data analysis methods is the limited set of skills obtained by chemical engineering within the traditional chemical engineering education. This emphasis area is aimed at developing a guideline on the sequence of elective classes for the students who wish to obtain a more in-depth knowledge of Process Control and related fields.

### ***Fundamentals of Engineering (FE) Exam***

All chemical engineering students must pass the morning and afternoon sessions of the Fundamentals of Engineering (FE) exam (formerly the Engineering-In-Training Exam) in order to graduate. The exam is administered by the State and is nationally composed and graded. The morning session includes general topics that are common to all engineering disciplines and the afternoon session focuses on topics that are specific to chemical engineering. The exam is given twice yearly and should be taken at the earliest possible date in the senior year or in April of the junior year. Information about the exam and registration can be found at <http://www.ncees.org>. The College and the Department usually conduct a “Fundamentals of Engineering Review Series” of lectures early fall semester. Please contact the Department office, 3290 Merrill Engineering Building, 581-6915, for more information.

The FE is developed and administered by the NCEES (National Council of Examiners for Engineering and Surveying). NCEES provides special testing accommodations for people with disabilities or religious convictions that preclude testing on Saturdays. More information can be found at <http://www.ncees.org>.

Students who do not pass the FE exam after two attempts are permitted to petition the Undergraduate Committee for an exception to policy. The petition should be submitted to the Chair of the Undergraduate Committee and must include (1) relevant information to support your petition and (2) the FE exam reports you received from all prior attempts. If your supporting information includes medical records, the petition should be submitted through the director of Disability Services.

### **VI. Advanced Placement (AP) Credit**

Students who take Advanced Placement (AP) courses in high school may receive college credit for certain University courses if they receive a certain minimum score on the AP exam. However the department will only accept credit that appears on your University of Utah transcript showing the tests taken and the test scores. The table on page 20 outlines placement in chemistry, math, and physics as determined by those departments. For more information on placement, see the General Catalog (<http://www.ugs.utah.edu/catalog/>) pages for Chemistry, Math, and Physics. The table below assigns a grade for each score and these are used in Chemical Engineering to determine your GPA for admission to intermediate status. If, for any reason, you decide to take a class for which you have received AP credit, we will use the grade you received in that class instead of the equivalent AP grade.

## Advanced Placement Credit Information for Chemical Engineering students

| Subject/AP Score           | Placement as determined by relevant department                  | Equivalent Grade <sup>4</sup> |
|----------------------------|---|-------------------------------|
| Chemistry                  |   |                               |
| 5                          | CHEM 2310 <sup>1</sup>  | A/A                           |
| 4                          | CHEM 2310 <sup>1</sup>  | B+/B-                         |
| Calculus <sup>2, 3</sup>   |   |                               |
| 5(AB)                      | MATH 1270 or 1250 or 1220                                       | A                             |
| 4(AB)                      | MATH 1270 or 1250 or 1220                                       | B-                            |
| 3 (AB)                     | MATH 1210   | No credit                     |
| 5(BC)                      | MATH 1280 or 1260 or 2210                                       | A/A                           |
| 4(BC)                      | MATH 1280 or 1260 or 2210                                       | B+/B-                         |
| 3(BC)                      | MATH 1220   | C+                            |
| Physics C Test (Mechanics) |   |                               |
| 5                          | Waiving PHYS 2210 requires approval from the Physics Department | A                             |
| 4                          |   | B                             |
| Physics C Test (E & M)     |   |                               |
| 5                          | Waiving PHYS 2220 requires approval from the Physics Department | A                             |
| 4                          |   | B                             |

1. Only the chemistry courses, CHEM 1210, 1220 are waived. Students must still take the corresponding laboratory associated with these courses, CHEM 1215 and 1225, unless they have already taken the equivalent AP chemistry laboratories with Prof. Tom Richmond (801)581-7487 in the Chemistry department at the University of Utah.
2. If you have not taken a math course recently, you may want to take MATH 15, a Precalculus Review. A strong foundation in math is necessary for many engineering courses.
3. Math 1210, 1250 or 1270 is a prerequisite to Physics 2210.
4. These grades will only be used to determine acceptance into intermediate status in Chemical Engineering. The U grants hours of credit, not grades, for AP scores of 3 or higher. Submit a request for evaluation to the Admissions Office to have your credits recorded.

## **VII. Honors in Engineering Program**

The Honors in Engineering Program in the College of Engineering is designed to provide a challenging, individualized educational experience to high achieving students and to promote life-long learning throughout their careers. The objective is to challenge top students by offering them access to more advanced levels of study, to facilitate the fullest possible use of their creative abilities, to encourage a sustained interest in advanced education and basic research, as well as to foster leadership and fellowship within the engineering community. Honors in Engineering is an undergraduate student honors program that is an option and not mandatory. Students can also receive Departmental Honors and/or University Honors in addition to Honors in Engineering.

For more information, including requirements and admission criteria, please refer to [http://www.coe.utah.edu/current/UG/Honors\\_in\\_Engineering](http://www.coe.utah.edu/current/UG/Honors_in_Engineering).

## **VIII. Transfer Students**

Students planning to transfer to the department from other colleges and universities should contact the transfer student adviser, Prof. Geoff Silcox, 3290 MEB, 801-581-8820, [geoff@che.utah.edu](mailto:geoff@che.utah.edu).

Transfer students who wish to be admitted to intermediate or major status, and who did not graduate from a State of Utah institution, must complete a Transfer Agreement ([http://www.che.utah.edu/~geoff/transfer\\_agre.xls](http://www.che.utah.edu/~geoff/transfer_agre.xls)) and meet with an advisor before they can apply. The advisor must approve all of the transfer credit by signing the Transfer Agreement.

## **IX. CO-OP Program**

The Cooperative Education Program (Co-op) seeks to provide students with practical experience to complement class-oriented learning. The industrial exposure that participants obtain is beneficial to students who hope to work in industry. In many cases, co-op experiences will occur at locations removed from campus with a strong possibility of being out of state. These opportunities are available with employers who have agreed to participate with the University of Utah.

Participants have generally completed (or will shortly complete) their sophomore-level courses and are selected by potential employers from a pool of applicants. The process of recruitment, interviewing, and selection is typically handled by Career Services.

Once employed in a co-op, students request admittance into CH EN 4977 or 4978. The former, 4977, may be used for up to 3 units of departmental technical elective credit. The latter, 4978, may count for up to 3 units of non-departmental technical elective credit. Students working part-time for an engineering employer during a semester may also apply for admittance to CH EN 4977 or 4978, and receive from 1 to 3 hours credit for their work experience. To receive credit, the student will be required to produce a 15-20 page report each time they register for CH EN 4977 or 4978. The report will describe

the engineering activities and work performed, and must meet acceptable academic standards of grammar and detail.

Participation in some co-op Programs will alter the suggested departmental program of study. Students will alternate semesters between engineering employment and on-campus study. Co-op participants must commit to their employer and to the department, that they will fulfill their employment obligations and complete full-time study while on-campus *without outside employment*. All students return to the University campus full time for their senior-level courses.

For deadlines and procedures, contact Diane Ward ([dward@careers.utah.edu](mailto:dward@careers.utah.edu), (801) 585-5060) in Career Services (<http://careers.utah.edu/>). All materials are processed through Career Services. For current co-op opportunities, contact Dr. Terry Ring ([ring@eng.utah.edu](mailto:ring@eng.utah.edu), 585-5705). Co-op opportunities are posted on the Chemical Engineering internship and co-op board as they arise.

If you will be missing a semester or more of classes due to co-op, please speak with Tracey Farnsworth, Academic Advisor ([farnsworth@eng.utah.edu](mailto:farnsworth@eng.utah.edu), 585-7175) or Geoff Silcox, Associate Chair ([geoff@che.utah.edu](mailto:geoff@che.utah.edu), 581-8820) before the semester begins.

## **X. Policy on Repeating Courses**

College of Engineering policy states that engineering students can only repeat a course once. Courses from which students have withdrawn are counted under this policy. Please contact Tracey Farnsworth or Geoff Silcox if you plan to repeat a course more than once.

## **XI. Departmental Scholarships**

The Department has a number of scholarships that are available to undergraduate students (<http://www.che.utah.edu/>, undergraduate page, scholarships). Application forms are available on the website. The department offers many scholarships for incoming and continuing students that are available from funds raised from industry or our alumni. In addition, there are a wide variety of University scholarships that are also available to incoming Chemical Engineering students from the Financial Aid & Scholarship Office, such as the Presidential or Honors-at-Entrance scholarships. Contact the Financial Aid & Scholarship Office, 105 SSB, 581-6211, for more information and application forms. The College of Engineering has a number of scholarships that are available to Chemical Engineering students; they can be contacted at 581-6911 or <http://www.coe.utah.edu>.

A number of loans are available through the College of Engineering.

## **XII. LEAP and E-LEAP Programs**

Engineering-LEAP (E-LEAP) is a year long, small class called a "seminar," focusing on the theme of community building in American and in global settings, and the ethical standards of engineering. This seminar keeps students together with one professor and classmates, while fulfilling the University's diversity requirement and two general



education requirements—one in Humanities and one in Social Science. In the first semester, students engage in a discussion about the American community experience as revealed through American autobiography and fiction. In the second semester, students build on the first semester concepts to consider the role of the engineer as a technical expert in contributing to community decision-making. In addition to its academic content, E-LEAP seminar emphasizes college writing, critical reading, group work, presentation skills, and library research strategies appropriate for engineering majors. Throughout the year, students network with College of Engineering faculty and advisors as well as the LEAP professor and a student advisor to learn more about careers in engineering. They also attend lectures and events about innovations in the engineering field. For more information contact the LEAP office at (801) 581-3811.

### **XIII. Student Organizations**

While your course work should be your top priority, participating in various student organizations and activities on campus can enhance your education at the University of Utah. This will enable you to interact with your colleagues outside of class and in an informal manner as well as acquaint you with all the supporting services the University and the College has to offer. The following table lists a few of the U of U student chapters you may want to consider.

| Organization  | Location, Tel. Number              | Contact                              |
|---|------------------------------------|--------------------------------------|
| American Institute of Chemical Engineers (AIChE)          | 3290H MEB<br>581-4460              | Prof. Ed Trujillo or<br>Kevin Whitty |
| Society of Women Engineers (SWE)                          | 206 Kennecott Building<br>581-8954 | Ms. Deidre<br>Schoenfeld             |
| Society of Hispanic Professional Engineers - (SHPE)       | 206 Kennecott Building<br>581-8954 | Ms. Deidre<br>Schoenfeld             |
| Program for Diversity in Engineering (PDE)                | 206 Kennecott Building<br>581-8954 | Ms. Deidre<br>Schoenfeld             |
| American Indian Science and Engineering Society (AISES) - | 206 Kennecott Building<br>581-8954 | Ms. Deidre<br>Schoenfeld             |
| Society of Ethnic Student Engineers (SESE)                | 206 Kennecott Building<br>581-8954 | Ms. Deidre<br>Schoenfeld             |

### **XIV. Policy on Prerequisites**

Students who do not meet the prerequisites for a course must submit a class permission code request through the Chemical Engineering website, [www.che.utah.edu](http://www.che.utah.edu). The following restrictions apply.

1. Requests are due one week prior to the first day of class. Timely responses to requests received after that date cannot be guaranteed.
2. If a student has taken the three courses required for major status (2300, 2450, and 2800) and they do not meet the 2.5 GPA and the minimum grade of C- requirements, the request will be rejected.
3. If a student has taken only one of the three majors-status courses, the request will be rejected.

4. If a student has taken two of the three major-status courses, and has achieved a 3.0 GPA or higher in those two, they may submit a request and be admitted to an upper-division course at the discretion of the instructor.
5. If a student is missing a prerequisite other than major status, they may submit a request and be admitted to a course at the discretion of the instructor.

## **XV. Combined BS/MS Program**

The Department offers a combined BS/MS degree program for undergraduate students interested in research. This program is designed to foster undergraduate research and to accelerate progress toward the Master of Science degree. Students in the combined program should begin their research while in the undergraduate portion of the program and may expect to complete the combined degree after five years with the simultaneous conferral of the Bachelor of Science and Master of Science degrees. This is one year less than a traditional sequential BS - MS program as described in the General Catalog. The BS degree portion of the combined degree requires the completion of 124 semester credit hours. The MS degree requires the completion of 30 additional hours. The standard BS degree requires 130 hours.

Students are encouraged to begin research in the summer following their junior year and often receive financial support. Most BS/MS students are also eligible for the University of Utah Tuition Benefit Program, once they are classified as graduate students.

The shift from undergraduate to graduate status occurs after completion of required undergraduate Chemical Engineering classes. Students wishing to exit the combined program can apply qualifying coursework toward the traditional BS and MS degree requirements without penalty. No student will be awarded a separate MS degree without satisfying all requirements for the BS degree.

### **SUGGESTED COMBINED BS/MS PROGRAM IN CHEMICAL ENGINEERING**

#### **FIRST YEAR**

##### **FALL SEMESTER**

MATH 1210 or 1270 Calculus I<sup>1</sup> (4)  
 CHEM 1210 General Chem I (4)  
 CHEM 1215 Gen Chem Lab I (1)  
 WRTG 2010 Intermed Writing (3)  
 CH EN 1703 Intro to ChE (2)  
 General Education (3)  
 TOTAL HOURS: 17

##### **SPRING SEMESTER**

MATH 1220 or 1280 Calculus II<sup>1</sup> (4)  
 CHEM 1220 General Chem II<sup>2</sup> (4)  
 CHEM 1225 Gen Chem Lab II (1)  
 PHYS 2210 Phyics Scien Eng I (4)  
 CH EN 4755 UG Seminar (0.5)  
 General Education (3)  
 TOTAL HOURS: 16.5

##### **SUMMER SEMESTER**

## SECOND YEAR

### FALL SEMESTER

MATH 2250 DEs and LA (4)  
ME EN 1300 Statics, Strength (4)  
PHYS 2220 Physcs Scien Eng II (4)  
PHYS 1809 Gen Physics Lab (1)  
CH EN 2450 Numerical Meth (2)  
General Education (3)

TOTAL HOURS: 18

### SPRING SEMESTER

MATH Technical Elective<sup>3</sup> (2 to 4)  
CH EN 2300 Thermodynamics I (2)  
CH EN 2800 Process Eng (3)  
CHEM 2310 Organic Chem I<sup>4</sup> (4)  
CHEM 2315 Organic Chem lab I<sup>4</sup> (1)  
CH EN 4755 UG Seminar (0.5)  
General Education (3)

TOTAL HOURS: 17.5

### SUMMER SEMESTER

## THIRD YEAR

### FALL SEMESTER

CHEM 3060 Quantum Chem (4)  
CH EN 3353 Fluid Mechanics (3)  
CH EN 3453 Heat Transfer (3)  
CH EN 3853 Chemical Eng  
Thermodynamics (3)  
CH EN 4753 UG Seminar (0.5)

TOTAL HOURS: 13.5

### SPRING SEMESTER

CH EN 3603 Mass Transfer and  
Separations (3)  
CH EN 3553 Chemical Reaction  
Engineering (3)  
CH EN 5103 Biochemical Eng (3)  
Technical Elective<sup>3</sup> (3)  
General Ed/Bachelor Degree Req (3)

TOTAL HOURS: 15

### SUMMER SEMESTER

Students are encouraged to  
begin working on Master's Thesis  
Research.

## FOURTH YEAR

### FALL SEMESTER

CH EN 4903 Projects Lab I (4)  
CH EN 4253 Process Design I (3)  
CH EN 4203 Process Control (3)  
CH EN 4753 UG Seminar (0.5)  
General Education (3)

TOTAL HOURS: 13.5

### SPRING SEMESTER

CH EN 4905 Projects Lab II<sup>5</sup> (3)  
CH EN 5253 Process Design II (3)  
Technical Elective<sup>3</sup> (4)  
General Education (3)

TOTAL HOURS: 13

### SUMMER SEMESTER

CH EN 6973 Thesis Research:  
Master's (3)

**TOTAL UNDERGRAD HOURS: 124**

## FIFTH YEAR

### FALL SEMESTER

CH EN 6353 Fluid Mechanics (3)  
CH EN 6853 Thermodynamics (3)  
Electives (6)<sup>6</sup>  
CH EN 7753 Grad Seminar (1)

TOTAL HOURS: 13

### SPRING SEMESTER

CH EN 6553 Chemical Reaction  
Engineering (3)  
CH EN 6603 Multicomponent Mass  
Transfer (3)  
Elective (3)<sup>6</sup>  
CH EN 7755 Grad Seminar (1)  
CH EN 6973 Thesis Research:  
Master's (1)

TOTAL HOURS: 11

**TOTAL GRADUATE HOURS: 30**

### SUMMER SEMESTER

CH EN 6973 Thesis Research:  
Master's (3)

1. Students with adequate math preparation are encouraged to take the MATH 1270 and 1280, Accelerated Engineering Calculus series, in place of MATH 1210 and 1220. Students who take 1210/1220 are encouraged to take MATH 2210 as a technical elective. The Mathematics Department requires a minimum grade of C in all math courses in order for them to serve as prerequisites for subsequent math courses.

2. Students who qualify should take CHEM 1221, Honors General Chemistry II and CHEM 1241, Honors General Chemistry Lab II, instead of CHEM 1220, General Chemistry II, and CHEM 1225, General Chemistry Lab II.

3. A total of 11 credit hours of technical elective courses are required as part of the BS portion of the program. At least two of those hours must be in an approved mathematic course and at least 6 must be in approved CH EN courses. See the Technical Electives Section of this handbook for a list of approved courses.

4. Students who qualify should take CHEM 2311, Honors Organic Chemistry I, instead of CHEM 2310.

5. CH EN 4905 fulfills the Upper Division Writing/Communication requirements.

6. BS/MS students may take their graduate electives earlier in their program of study, if their schedule permits it.

## APPLICATION / ADMISSION PROCEDURES

Undergraduate students must apply to the combined BS/MS program by May 1<sup>st</sup> of the year in which they are enrolled in CH EN 3603, Mass Transfer and Separations. The department will notify applicants within ten days of the date on which spring grades are posted. An undergraduate GPA of at least 3.3, based on all undergraduate work or work completed during the last two years of study, whichever is higher, is required. Students must be supported by a faculty member who will be their research advisor for a master's thesis. The faculty member must be able to support the student as a Research Assistant for the graduate portion of this program.

Applicants who do not qualify for the BS/MS program are encouraged to apply to the traditional MS program.

To apply for admission to the BS/MS program, submit the following three items:

1. A completed Chemical Engineering BS/MS application. This application can be found at <http://www.che.utah.edu/>. Please go to the undergraduate page and select Forms and Applications.
2. A letter of support from the faculty member who will be your research advisor for your master's thesis. The letter must include a commitment from the faculty member to support you as a Research Assistant for the graduate portion of this program.
3. A current Degree Audit Report (DARS).

Mail or deliver all materials to:

Tracey Farnsworth, Academic Advisor  
University of Utah Chemical Engineering Department  
50 S Central Campus Drive RM 3290 MEB  
Salt Lake City, Utah 84112-9203

Once admitted, the student must complete a University of Utah Graduate School application and will need to pay the appropriate fee. Students should apply to the Graduate School to be admitted the summer following the semester in which the student completes Projects Lab II and Process Design II. Students should comply with Admissions Office deadlines.

Admitted students must submit a BS/MS program of study to the department during the fall semester that their fourth year. Students must follow all guidelines for the Masters of Science program that are listed within the Graduate Handbook.

### **XVI. Undergraduate Courses offered in the Department (CH EN)**

A complete list of Chemical Engineering course offerings is available in the online Catalog at [http://www.acs.utah.edu/GenCatalog/crsdesc/ch\\_en.html](http://www.acs.utah.edu/GenCatalog/crsdesc/ch_en.html). As with all

engineering courses, the prerequisites for each class must be completed by the time of registration. The minimum acceptable grade in required CH EN courses is C-.