

CHEMICAL ENGINEERING – 2018-2019 Curriculum Brigham Young University

The Discipline

Chemical Engineering deals with the development and application of manufacturing processes in which chemical and physical changes of materials are involved. Chemical engineers study and develop new methods to manage energy resources as well as commercial consumer products. They design reliable, cost-effective manufacturing plants with emphasis on safety and environmental friendliness. As problem solvers, chemical engineers work on the leading edge of technology—researching and developing the ideas of today for the designs, systems, and products of tomorrow.

Areas of instruction include heat transfer, fluid dynamics, environmental and safety design, chemical reaction kinetics, thermodynamics, separation operations, materials science, process control, and plant design. In addition, chemical engineering places strong emphasis on computer skills.

The BS curriculum is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc. (ABET) and the American Institute of Chemical Engineers.

Career Opportunities

The combination of knowledge about engineering, math, and chemistry obtained in the chemical engineering curriculum is a versatile preparation that opens a wide variety of opportunities to graduates. This versatility is one reason why chemical engineers have traditionally been among the highest paid professionals in the engineering and science disciplines.

Chemical engineers make a significant difference in our quality of life. Some develop clean, new energy sources to power society. Some develop and produce fertilizers and other agricultural chemicals to assist in feeding mankind. Virtually all pharmaceuticals are produced by chemical engineers to enhance the life of millions. Others study and produce biomedical devices and artificial organs. Still others are involved in development and production of new materials for use in new high-tech products. Engineers produce chemicals ranging in use from cleaning products to medicines and from man-made fibers for clothing and textiles to plastics for construction and consumer goods.

The petroleum industry has traditionally employed a large number of chemical engineers, requiring their

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expertise for the discovery, production, and refining of petro-chemicals including fuels, chemicals, and oils. The information age has fueled enormous expansion of the semiconductor industry in which an ever growing number of chemical engineers are employed. Many chemical engineers are employed in environmentally related positions, working on ways to improve air and water quality, to reduce acid rain and smog, and to recycle and reduce garbage. Additionally, chemical engineers are employed by universities as teachers and researchers and by government agencies to provide answers for energy, environmental, and defense concerns. Chemical engineers also train to work in the medical, business, and legal professions.

Although chemical engineering career opportunities are diverse, job functions can be categorized more easily. Chemical engineers are usually involved in research, design, development, production, technical sales, or management.

In research, they develop new ideas, new products, and new ways to produce existing products more economically and with less environmental impact. In design, they create the processes that convert raw materials into finished products with emphasis on efficiency, safety, consumer needs, and environmental protection. The development engineer improves existing processes and technology to better meet changing needs. Process engineering involves production processes and operations. Management and technical sales involve decision making with regard to consumer needs and technical capabilities. Chemical engineers are creative problem solvers. Their careers are rewarding not only from an intellectual and financial view, but also from a personal perspective. Their solutions provide a better lifestyle for mankind.

Academic Standards Policy

To help students 1) identify if chemical engineering is a good academic fit, 2) successfully complete the chemical engineering program, and 3) become technically competent engineers capable of performing professional duties in the field, the department has set the academic standards enumerated below. For this policy, major courses are defined as those used to fulfill the Program Requirements listed for a BS in Chemical Engineering in the Undergraduate Catalog and are found under subheadings preprofessional, professional, supporting, and technical electives. Since all grades earned for a course (original and retakes) are retained in university records and GPA calculations, only the most recent

grades for retaken courses are considered for purposes of this policy. Also, this policy only applies to those courses used to fulfill graduation requirements.

- To ensure proper preparation for and successful completion of the chemical engineering program, students must meet the following criteria to register for any upper-division professional courses (i.e. Ch En courses 300 level and above),
 - Have no more than 4 total hours of less than C- credit in any preprofessional or supporting course(s) satisfying program requirements, only 3 of which can be from chemical engineering courses.
 - Pass Ch En 273 with a C- or above.
- To help correct technical weaknesses as soon as they are identified, a student who accumulates grades below C- in excess of 6 hours in any course(s) satisfying major requirements (preprofessional, professional, supporting, and technical electives) may not take further chemical engineering courses until the unacceptable credits have been reduced to 6 hours or less.
- To demonstrate that graduates from the chemical engineering department are technically competent to perform professional duties in the field, a student may not graduate with more than 4 total hours below C- in any course(s) satisfying major requirements (preprofessional, professional, supporting, and technical electives), only 3 of which can be from chemical engineering.

Undergraduate Admittance Requirements

The Chemical Engineering Department offers a professional program leading to the Bachelor of Science degree. The first two years of this program are considered to be pre-professional and permit unrestricted enrollment for any student who qualifies for admission to the university. The remaining two years are considered to constitute the professional program. All students are highly urged to declare their major upon first entry to the university or as soon thereafter as possible by contacting the college advisement center, or by going online to MyMap.

Students can apply to the professional program once the following conditions have been met:

- a. Passed ChEn 273 and Math 302.
- b. Passed 7 of the 9 following classes (or suitable equivalents): Chem 111, Chem 112, Chem 357, Math 112, Math 113, Math 303, ChEn 170, ChEn 263, Phscs 121.
- c. Complied with the **Academics Standards Policy** (see above).

- d. Submitted a completed *Application for the Chemical Engineering Professional Program* to the department.

Applications for the professional program are due each April 15 but may be submitted any time prior to that date. See the department website for complete instructions. Transfer students should talk with the department academic advisor immediately after arriving on campus to plan courses.

There is a strong correlation between successful completion of the professional program and student performance in the pre-professional program. Poor grades in these classes suggest inadequate preparation for professional program class work or a poor match between student aptitudes and the skill set required in the chemical engineering major.

General Information

Internships, Co-ops, Undergraduate Research, and Projects. In order to gain hands-on experience, students are encouraged to seek out opportunities to do internships, co-ops, research with a faculty member, and other project-based learning (e.g. Global Engineering Outreach). Academic credit can be awarded for these activities. See the department webpage for more information. Credit for internships and co-ops must be approved by the department academic advisor *prior to* beginning the experience.

Technical Electives

The Chemical Engineering Department requires 15 hours of technical electives. These 15 hours are divided into three categories: 1) Advanced chemistry lab (2 hrs.), 2) Engineering electives (9 hrs.), 3) EMSB (Engineering, Math, Science, Business) electives (4 hrs.) Of the 13 Engineering and EMSB elective hours at least 4, but no more than 7 must be courses that provide opportunity for development and demonstration of skills needed to solve complex engineering problems, otherwise known as Innovation courses. Of the minimum 4 hours of innovation type courses, at least 3 of these hours must be Engineering Problem Solving through Experiential Learning (EPSEL) hours from which a senior thesis is produced and delivered. See the department website for a full list of advanced chemistry lab, engineering elective, EMSB elective, INNOV, and EPSEL approved courses and examples of course combinations satisfying the EPSEL and INNOV requirement. The chemical engineering website also contains a page with recommended elective courses based on chemical engineering focus allowing students to personalize their education toward future goals. Information on technical electives is on the Undergraduate tab of the chemical engineering website.

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For more information see:

[Major Requirements](#)

1. Students are strongly encouraged to consult with the department about their course scheduling.

2. Complete the following preprofessional courses:

Ch En 170	Introduction to Chemical Engineering	2.0
Ch En 191	Preprofessional Seminar	0.5
Ch En 263	Computational Tools for Chemical Engineers	2.0
Ch En 273	Chemical Process Principles	3.0
Ch En 291	Career Skills 1	0.5
Math 112	Calculus 1	4.0
Math 113	Calculus 2	4.0
Phscs 121	Principles of Physics 1	3.0
Ec En 301	Elements of Electrical Engineering	3.0

[And complete one of the following options:](#)

Either

Chem 111	Principles of Chemistry	4.0
Chem 112	Principles of Chemistry	3.0

Or (though not recommended)

Chem 105	General College Chemistry	4.0
Chem 106	General College Chemistry	3.0
Chem 107	General College Chemistry Laboratory	1.0

3. Complete one of the following options:

Either

Math 302	Mathematics for Engineers 1	4.0
Math 303	Mathematics for Engineers 2	4.0

Or

Math 313	Elementary Linear Algebra	3.0
Math 314	Calculus of Several Variables	3.0
Math 334	Ordinary Differential Equations	3.0

4. Complete the following professional courses:

Ch En 285	Chemical Process and Fluids Lab	0.5
Ch En 311	Chemical Engineering and Society	3.0
Ch En 345	Materials and Reactions Lab	0.5
Ch En 373	Chemical Engineering Thermodynamics	3.0
Ch En 374	Fluid Mechanics	3.0
Ch En 376	Heat and Mass Transfer	3.0
Ch En 378	Science of Engineering Materials	3.0
Ch En 385	Thermodynamics and Transport Lab	0.5
Ch En 386	Chemical Reaction Engineering	3.0
Ch En 391	Career Skills	1.0
Ch En 436	Process Control and Dynamics	3.0
Ch En 445	Separations and Process Control Lab	0.5
Ch En 451	Chemical Engineering Plant Design and Process Synthesis	4.0
Ch En 476	Separations	3.0
Ch En 479	Unit Operations Laboratory	2.0

5. Complete the following supporting courses:

* Biology	Bio 100** , Bio 130 , MMBio 221 , MMBio 240 , or PDBio 120	3.0
Chem 357	Industrial Organic Chemistry	3.0
Chem 467	Physical Chemistry for Engineers	3.0
Econ 110	Economic Principles and Problems	3.0
Engl 316	Technical Communication	3.0
Stat 201	Statistics for Engineers and Scientists	3.0

* The university counts other options for Biology, but only those listed may count towards the BS chemical engineering requirement.

** Bio 100 is introductory and is not recommended for students with biology experience in high school.

6. [Complete technical electives \(15 hours minimum\) satisfying the following requirements:](#)

- o [Complete 2 hours of advanced chemistry laboratory](#)
- o [Complete 9 hours of approved advanced \(300-level or above\) engineering \(ENG\) course work](#)
- o [Complete 4 hours of approved advanced \(300-level or above\) EMSB[†] course work](#)
- o [4-7 hours of the 13 ENG/EMSB elective hours must involve EPSEL/INNOV[‡]](#)

[†] Engineering, Math, Science, Business

[‡] Engineering Problem Solving through Experiential Learning/Innovation

7. [Pass a basic competency exam \(L3 exam\) administered by the chemical engineering department.](#)

University Core Requirements

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For more information see:

[General Education Requirements](#)

Note: Courses in *Red, Italicized font* double count with major requirements

1. Doctrinal Foundations

Religion Required

Eter Fam	The Eternal Family
Restoration	Foundations of the Restoration
ChristGosp	Jesus Christ and the Everlasting Gospel
B of M	Teachings & Doctrine of the Book of Mormon

Religion Electives

Rel Elec 1	Religion Elective 1
Rel Elec 2	Religion Elective 2
Rel Elec 3	Religion Elective 3

2. The Individual and Society

American Heritage

A Htg 100	American Heritage
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Global and Cultural Awareness

GCA	Take a course that double counts as either Lett/GCA or Art/GCA (see below)
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3. Skills

First Year Writing

Wrtg 150	Writing and Rhetoric
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Advanced Written & Oral Communication

<i>Engl 316</i>	<i>Advanced Writing</i>
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Quantitative Reasoning

<i>Math 112</i>	<i>Calculus 1</i>
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Languages of Learning

<i>Math 113</i>	<i>Calculus 2</i>
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4. Arts, Letters, and Sciences

Civilization 1

Civ 1	Take one course which counts as Civilization 1. Click here and see "CIVILIZATION 1" for the approved list.
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Either

Civilization 2/Letters

Civ 2/Lett	Take one course which counts as <i>both</i> Civilization 2 and Letters . Click here and see "CIVILIZATION 2" for the approved list.
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Arts

Art/GCA	Take one course which counts as <i>both</i> Arts and Global & Cultural Awareness . Click here and see "ARTS" for the approved list.
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Or

Civilization 2/Arts

Civ 2/Art	Take one course which counts as <i>both</i> Civilization 2 and Arts . Click here and see "CIVILIZATION 2" for the approved list.
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Letters

Lett/GCA	Take one course which counts as <i>both</i> Letters and Global & Cultural Awareness . Click here and see "LETTERS" for the approved list.
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Biological Science

<i>Biology</i>	Take one of the following options* <ul style="list-style-type: none">• <i>Bio 100**</i>• <i>Bio 130</i>• <i>MMBio 221</i>• <i>MMBio 240</i>• <i>PDBio 120</i>
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Physical Science

<i>Chem 111</i>	<i>Principles of Chemistry</i>
<i>Phscs 121</i>	<i>Principles of Physics 1</i>

Social Science

<i>Econ 110</i>	<i>Economic Principles and Problems</i>
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The University Core requires students to complete Civilization 2, Arts, Letters, and GCA (Civ2/Art/Lett/GCA). If done properly, these four requirements may be met by taking only two courses. Each Civilization 2 course double-counts as either Arts, Letters, or GCA. Make sure to take a Civilization 2 course that counts as either Arts or Letters *but not* GCA. If the chosen Civilization 2 course counts as Arts, take a Letters course that double-counts as GCA. If the chosen Civilization 2 course counts as Letters, take an Arts course that double-counts as GCA. These sequences are summarized below.

Suggested Sequence 1:

Course 1: Civ 2/Lett

Course 2: Art/GCA

Example

Course 1: CL CV 202 (counts as Civ 2 and Lett)

Course 2: MUSIC 203 (counts as Art and GCA)

Suggested Sequence 2:

Course 1: Civ 2/Art

Course 2: Lett/GCA

Example

Course 1: ARTHC 202 (counts as Civ 2 and Art)

Course 2: IHUM 242 (counts as Lett and GCA)

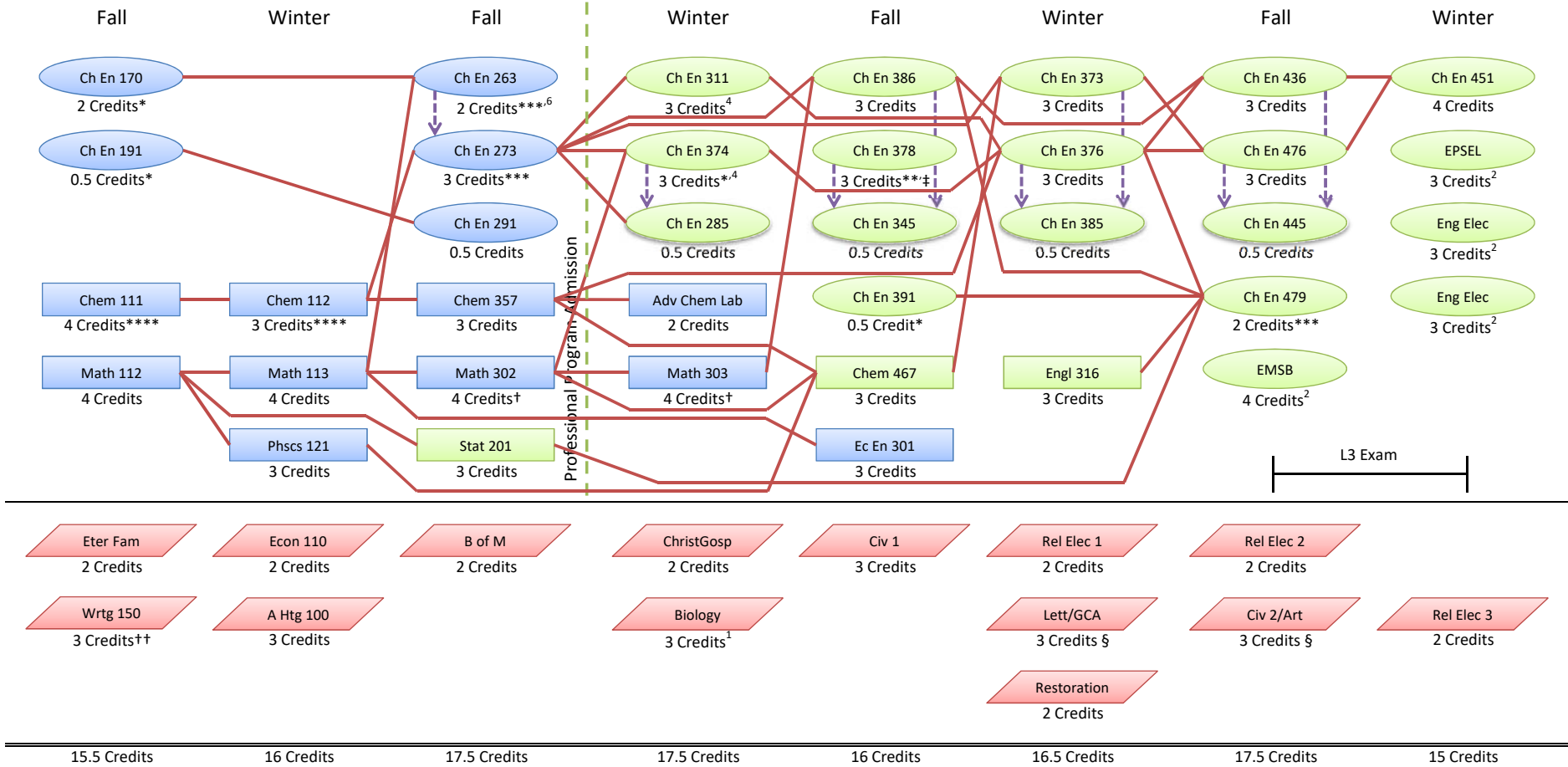
* The university counts other options for Biology, but only those listed may count towards the BS chemical engineering requirement.

** Bio 100 is introductory and is not recommended for students with biology experience in high school.

Chemical Engineering Flow Chart (Eight Semesters)

Catalog Year 2018-2019

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Color Legend

- Preprofessional Course
- Professional Program Course
- University Core

Shape Legend

- Major-required Courses (Chemical Engineering)
- Major-required Courses (non-Chemical Engineering)
- University Core Courses³
- Solid lines (from left to right) represent prerequisites.⁵
- - - Dashed lines represent concurrent enrollment.

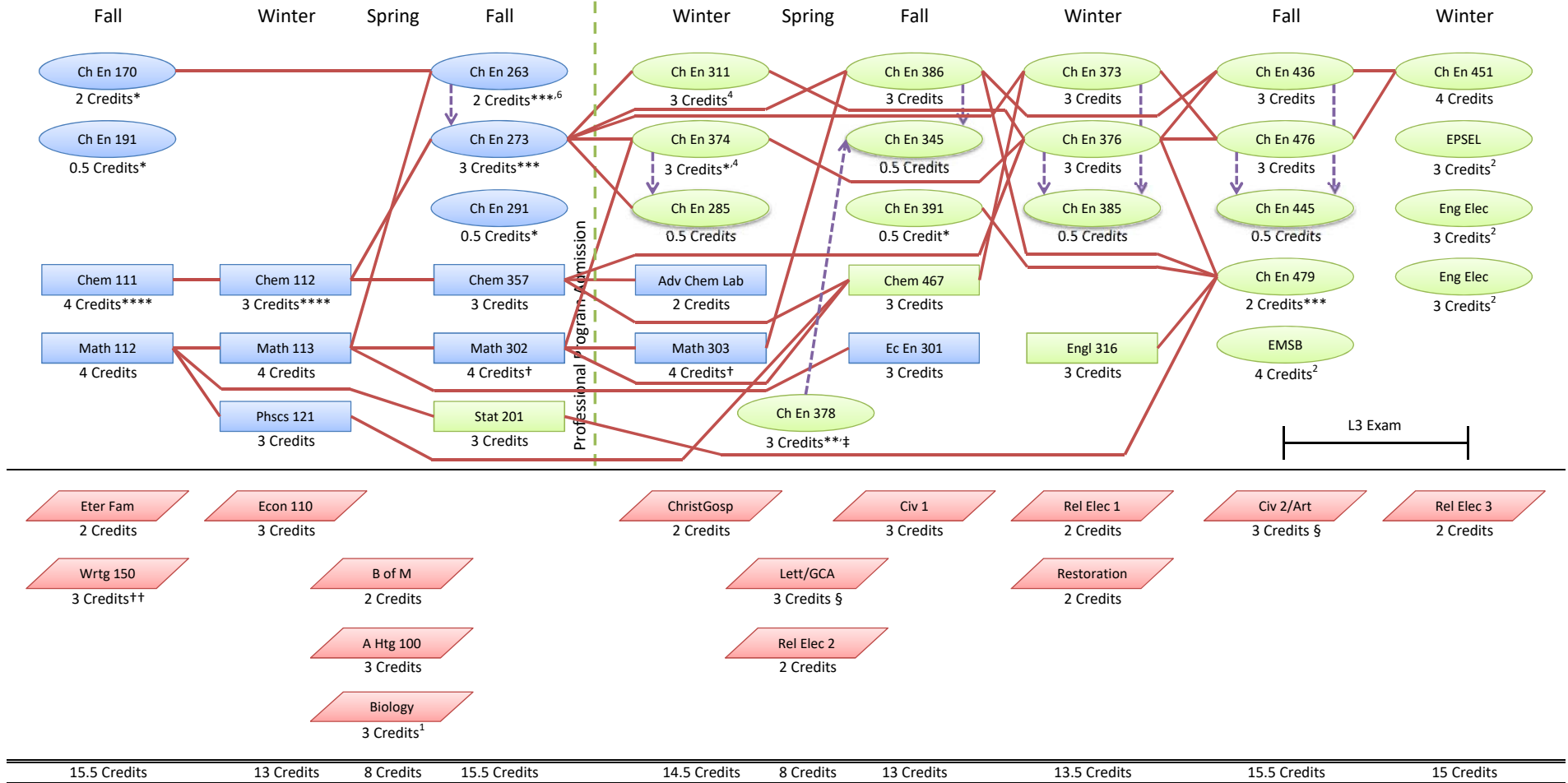
- * Available F or W
- ** Available Sp
- *** Available F, W, or Sp
- **** Or 105, 106, 107 (not recommended)
- † Or 313, 314, 334
- ‡ May be taken in soph. or junior year
- †† Or Engl 115
- § Or Civ2/Lett, Art/GCA

- Notes:**
1. Bio 130, MMBio 221, MMBio 240, or PDBio 120. Bio 100 counts but is not recommended.
 2. Many Eng and EMSB courses may be taken earlier than shown above as long as prerequisites are met.
 3. Most University Core courses may be taken in any order, but Wrtg 150 should be taken prior to Engl 316.
 4. Though not required, Ch En 311 should be taken before or concurrently with Ch En 374
 5. Pay very close attention to prerequisites. You will not be allowed to take courses without fulfilling the prerequisites even if it means delaying graduation a year.
 6. Courses can be taken early if prerequisites are met. For example, students passing the Calculus BC AP Exam with a 5 receive credit for Math 112/113 and could take Ch En 263 in Winter of the first year after taking Ch En 170 in the Fall.

Chemical Engineering Flow Chart (Eight Semesters, Two Terms)

Catalog Year 2018-2019

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Color Legend	Shape Legend
<ul style="list-style-type: none"> ● Preprofessional Course ● Professional Program Course ● University Core 	<ul style="list-style-type: none"> Major-required Courses (Chemical Engineering) Major-required Courses (non-Chemical Engineering) University Core Courses³ — Solid lines (from left to right) represent prerequisites.⁵ - - - Dashed lines represent concurrent enrollment.

* Available F or W
** Available Sp
*** Available F, W, or Sp
**** Or 105, 106, 107 (not recommended)
† Or 313, 314, 334
‡ May be taken in soph. or junior year
†† Or Engl 115
§ Or Civ2/Lett, Art/GCA

- Notes:**
1. Bio 130, MMBio 221, MMBio 240, or PDBio 120. Bio 100 counts but is not recommended.
 2. Many Eng and EMSB courses may be taken earlier than shown above as long as prerequisites are met.
 3. Most University Core courses may be taken in any order, but Wrtg 150 should be taken prior to Engl 316.
 4. Though not required, Ch En 311 should be taken before or concurrently with Ch En 374.
 5. Pay very close attention to prerequisites. You will not be allowed to take courses without fulfilling the prerequisites even if it means delaying graduation a year.
 6. Courses can be taken early if prerequisites are met. For example, students passing the Calculus BC AP Exam with a 5 receive credit for Math 112/113 and could take Ch En 263 in Winter of the first year after taking Ch En 170 in the Fall.

