### University Core and Graduation Requirements

#### University Core Requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Classes</th>
<th>Hours</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Religion Cornerstones</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachings and Doctrine of The Book of Mormon</td>
<td>1</td>
<td>2.0</td>
<td>REL A 275</td>
</tr>
<tr>
<td>Jesus Christ and the Everlasting Gospel</td>
<td>1</td>
<td>2.0</td>
<td>REL A 250</td>
</tr>
<tr>
<td>Foundations of the Restoration</td>
<td>1</td>
<td>2.0</td>
<td>REL C 225</td>
</tr>
<tr>
<td>The Eternal Family</td>
<td>1</td>
<td>2.0</td>
<td>REL C 200</td>
</tr>
<tr>
<td><strong>The Individual and Society</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Heritage</td>
<td>1-2</td>
<td>3-6.0</td>
<td>from approved list</td>
</tr>
<tr>
<td>Global and Cultural Awareness</td>
<td>1</td>
<td>3.0</td>
<td>from approved list*</td>
</tr>
<tr>
<td><strong>Skills</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Year Writing</td>
<td>1</td>
<td>3.0</td>
<td>from approved list</td>
</tr>
<tr>
<td>Advanced Written and Oral Communications</td>
<td>1</td>
<td>3.0</td>
<td>ENGL 316</td>
</tr>
<tr>
<td>Quantitative Reasoning</td>
<td>1</td>
<td>4.0</td>
<td>MATH 112 or MATH 113</td>
</tr>
<tr>
<td>Languages of Learning (Math or Language)</td>
<td>1</td>
<td>4.0</td>
<td>MATH 112</td>
</tr>
<tr>
<td><strong>Arts, Letters, and Sciences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civilization 1</td>
<td>1</td>
<td>3.0</td>
<td>from approved list</td>
</tr>
<tr>
<td>Civilization 2</td>
<td>1</td>
<td>3.0</td>
<td>from approved list*</td>
</tr>
<tr>
<td>Arts</td>
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<td>from approved list*</td>
</tr>
<tr>
<td>Letters</td>
<td>1</td>
<td>3.0</td>
<td>from approved list*</td>
</tr>
<tr>
<td>Biological Science</td>
<td>1</td>
<td>3.0</td>
<td>from approved list**</td>
</tr>
<tr>
<td>Physical Science</td>
<td>2</td>
<td>7.0</td>
<td>CHEM 105 or 111, and PHSCS 121</td>
</tr>
<tr>
<td>Social Science</td>
<td>1</td>
<td>3.0</td>
<td>ECON 110</td>
</tr>
<tr>
<td><strong>Core Enrichment: Electives</strong></td>
<td></td>
<td></td>
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<tr>
<td>Religion Electives</td>
<td>3-4</td>
<td>6.0</td>
<td>from approved list</td>
</tr>
<tr>
<td>Open Electives</td>
<td>Variable</td>
<td>Variable</td>
<td>personal choice</td>
</tr>
</tbody>
</table>

*American Heritage can be satisfied by taking A HTG 110, ECON 110 + HIST 220, or ECON 110 + POLI 110. Since ECON 110 is required for the major, students may take HIST 220, POLI 110, or A HTG 110 to satisfy the American Heritage requirement.

**REDUCTION OF TOTAL CREDITS IS RECOMMENDED by choosing a Civilization 2 course that double counts for the Arts requirement (Civ 2/Art) and a Letters course the double counts for the Global and Cultural Awareness requirement (Lett/GCA). (You may also do a Civ 2/Lett + Art/GCA pairing.) See the University Core list for specifics (core.byu.edu).

**The department Biology requirement may be satisfied by taking one of the following courses: BIO 100, BIO 130, MMBIO 221, MMBIO 240, or PDBIO 120. Each of these also satisfies the University Core requirement for Biological Sciences. BIO 100 is introductory in nature and is not recommended for students who had any biology in high school. See the department website for more information.

### Suggested Sequence of Courses

#### FRESHMAN YEAR

**1st Semester**
- WRTG 150 3.0
- CH EN 170 4.0
- CHEM 111 4.0
- MATH 112 4.0
- CH EN 191 0.5
- Religion Cornerstone course 2.0
- Total Hours 15.5

**2nd Semester**
- American Heritage 3.0
- PHSCS 121 3.0
- CHEM 112 3.0
- MATH 113 4.0
- ECON 110 4.0
- Total Hours 16.0

#### SOPHOMORE YEAR

**3rd Semester**
- CH EN 263 2.0
- CH EN 273 3.0
- CH EN 291 0.5
- Religion Cornerstone course 2.0
- American Heritage 3.0
- CHEM Lab elective 2.0
- Total Hours 17.5

**4th Semester**
- CH EN 374 3.0
- CH EN 311 3.0
- CH EN 385 0.5
- Religion Cornerstone course 2.0
- Religion elective 2.0
- Total Hours 17.5

#### JUNIOR YEAR

**5th Semester**
- CH EN 378 3.0
- CH EN 386 3.0
- CH EN 391 0.5
- CHEM 467 3.0
- Religion Cornerstone course 2.0
- Total Hours 15.5

**6th Semester**
- CH EN 373 3.0
- CH EN 376 3.0
- CH EN 385 0.5
- ENGL 316 3.0
- Religion elective 2.0
- Letters/GCA course 3.0
- Total Hours 16.5

#### SENIOR YEAR

**7th Semester**
- CH EN 436 3.0
- CH EN 476 3.0
- CH EN 445 0.5
- Religion elective 2.0
- Civilization 2/Arts course 3.0
- Total Hours 17.5

**8th Semester**
- CH EN 451 4.0
- EPSEL elective 3.0
- Religion elective 2.0
- Engineering elective 3.0
- Religion elective 2.0
- Total Hours 15.0
BS in Chemical Engineering (392150)
2019-2020 Program Requirements (101.5 - 103.5 Credit Hours)

Due to the complex prerequisite relationships and limited scheduling of these courses, students should consult with the department about their course scheduling.

**REQUIREMENT 1** Complete 3 options

**PREPROFESSIONAL COURSES:**

**OPTION 1.1** Complete 9 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
- EC EN 301 - Elements of Electrical Engineering 3.0
- *MATH 112 - Calculus 1* 4.0
- MATH 113 - Calculus 2 4.0
- PHSCS 121 - Introduction to Newtonian Mechanics 3.0

**OPTION 1.2** Complete 1 group

**GROUP 1.2.1** Complete 2 courses
- CHEM 111 - Principles of Chemistry 1 4.0
- CHEM 112 - Principles of Chemistry 2 3.0

**GROUP 1.2.2** Complete 1 group

**GROUP 1.2.2.1** Complete 1 course
- MATH 213 - Elementary Linear Algebra 2.0
- MATH 313 - (Not currently offered)

**GROUP 1.2.2.2** Complete 2 courses
- MATH 314 - Calculus of Several Variables 3.0
- MATH 334 - Ordinary Differential Equations 3.0

**OPTION 1.3** Complete 1 group

**GROUP 1.3.1** Complete 2 courses
- MATH 302 - Mathematics for Engineering 1 4.0
- MATH 303 - Mathematics for Engineering 2 4.0

**GROUP 1.3.2** Complete 2 selections

**SELECTION 1.3.2.1** Complete 1 course
- MATH 213 - Elementary Linear Algebra 2.0

**SELECTION 1.3.2.2** Complete 2 courses
- MATH 314 - Calculus of Several Variables 3.0
- MATH 334 - Ordinary Differential Equations 3.0

**REQUIREMENT 2** Complete 15 courses

**PROFESSIONAL COURSES:**

- CH EN 285 - Chemical Process and Fluids Lab 0.5
- CH EN 311 - Chemical Engineering and Society-Health, Safety, and the Env 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 2 0.5
- 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 0.5

**REQUIREMENT 3** Complete 6 courses

**SUPPORTING COURSES:**

- BIO 100 - Principles of Biology 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

**REQUIREMENT 4** Complete 4 options

**COMPLETE TECHNICAL ELECTIVES (15 HOURS MINIMUM) SATISFYING THE FOLLOWING REQUIREMENTS:**

**OPTION 4.1** Complete 2.0 hours from the following course(s)

**A. CHEMISTRY LABORATORY:**
- CHEM 353 - Organic Chemistry Laboratory--Nonmajors 2.0v
- CHEM 464 - Physical Chemistry Laboratory 1 1.0
- CHEM 465 - Physical Chemistry Laboratory 2 1.0

**OPTION 4.2**

B. Complete 9 hours of approved advanced engineering (ENG) course work. In general, these courses are 300-level or above from any of the following departments: Chemical Engineering; Civil & Environmental Engineering; Electrical & Computer Engineering; Mechanical Engineering; or the School of Technology. For details and exceptions, see the department webpage.

**OPTION 4.3**

C. Complete 4 hours of approved advanced course work from an engineering, math, science, or business (EMS) department. In general, these courses are 300-level or above from any of the following colleges: College of Engineering & Technology, College of Physical & Mathematical Sciences, College of Life Sciences, and the Marriott School of Business. For details and exceptions, see the department webpage.

**OPTION 4.4**

D. At least 4 hours, but no more than 7 hours, of the above technical electives (OPTIONS 4.2 and 4.3) must be from courses that provide opportunity for development and demonstration of skills needed to solve complex engineering problems. At least 3 of these hours must focus on Engineering Problem Solving through Experiential Learning (EPSEL) from which a senior thesis is produced and delivered. The remaining hour(s) (from 1 to 4) may be from EPSEL course(s) or from course(s) that focus on projects, creativity, and/or innovation skills (collectively called INNOV). Example courses satisfying both EPSEL and INNOV requirements are found below. See the department website for a full list of approved courses and more information on the senior thesis requirements.

**Courses and Combinations of Courses Satisfying the EPSEL Requirement:**

- CH EN 461 (3 credits), CH EN 499 (3 credits), CH EN 199R (1 credit) + CH EN 496 (2 credits), ENG T 497R (3 credits), ME EN 475 + ME EN 476 (6 total credits). EPSEL courses are classified as ENG.

**Courses Satisfying the INNOV Requirement:**

- CH EN 199R (Internship), CH EN 498R (Mentored Research), ENG T 497R (Global Engineering Outreach). A course taken for the INNOV requirement will count as either ENG or EMSB depending on the department in which it is listed.

**REQUIREMENT 5**

Pass a basic competency exam (L3 exam) administered by the Chemical Engineering Department. All students in the chemical engineering program must pass a competency exam based on the foundational principles of chemical engineering that are taught in the program courses. The exam will be administered during the senior year with the specific dates announced each year by the Chemical Engineering Department. Each fail, the department will supply written rules, guidelines, and reference material to help students prepare to take the exam.

**THE DISCIPLINE:**

Chemical engineering is the application of chemistry, biology, physics, mathematics, computer skills, and economics to designing, developing, and implementing chemical processes that convert raw materials into more useful, valuable products. Engineering skills are required for design, testing, scale-up, operation, control, and optimization. Applications range in size from the molecular level to large chemical production facilities, with objectives ranging from economic performance to protection of the environment and the safety of workers and consumers. Chemical engineers
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2019-2020

are engaged in developing and producing a diverse range of products from raw materials to commodity and specialty chemicals. These products include high-performance materials needed for aerospace, automotive, biomedical, electronic, environmental and military applications. Chemical engineers work in a variety of industries, including chemical manufacturing, energy, biotechnology, electronics, food, clothing, paper, healthcare, and business services.

PROFESSIONAL PROGRAM ADMISSION POLICY:
Admission to the professional program is available to all students in good academic standing with the university who have (a) passed the prerequisite courses for the first-semester professional courses, namely CH EN 273 and MATH 302, and (b) submitted to the department an Application for the Chemical Engineering Professional Program. The Application for the Chemical Engineering Professional Program requires students to meet with their department advisor for direction and counseling with regard to performance in the preprofessional program courses and successful completion of the professional program.

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.

1. 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): a) 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. b) Pass CH EN 273 with a C- or above.

2. 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.

3. 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.

RESEARCH:
The Department of Chemical Engineering has a highly qualified faculty with a wide range of experience in both industry and research. Many areas of research are being pursued, including: 1) converting coal to clean gaseous fuels; 2) combustion of coals and other fuels as well as rocket propellants; 3) developing new storage batteries; 4) measurement and prediction of physical, chemical, and thermodynamic, and transport properties of liquids, gases, and solids; 5) molecular simulations; 6) chemical processes and materials in biological systems, including the human body; 7) catalysis, with emphasis on forming and reforming hydrocarbon fuels; 8) computer control of chemical processes; 9) sustainable energy; and 10) mathematical modeling of chemical processes and phenomena.

INTERNSHIPS, CO-OP EDUCATION:
Encouraged.

HONORARY SOCIETIES AND CLUBS:
American Institute of Chemical Engineers (AIChE), Sigma Xi, Tau Beta Pi.

FINANCING OF EDUCATION:
Scholarships, research assistantships, and teaching assistantships are available.

CAREER OPPORTUNITIES:
The combination of knowledge about process 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 feed 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. Chemical 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. Another large employer of chemical engineers is the semiconductor industry. Chemical engineers assist in the design and manufacturing of semiconductor chips and circuit boards. This work involves significant knowledge of chemistry and related processes. The petroleum industry is a large employer of chemical engineers, requiring their expertise for the discovery, production, and refining of petro-chemicals including fuels, chemicals, and oils. 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. Though 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. Production engineering involves supervision, quality control, and testing of 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. Affecting the lives of millions, their solutions provide a better lifestyle for mankind.

MAP DISCLAIMER

While every reasonable effort is made to ensure accuracy, there are some student populations that could have exceptions to listed requirements. Please refer to the university catalog and your college advisement center/department for complete guidelines.

DEPARTMENT INFORMATION

Chemical Engineering
Brigham Young University
330 Engineering Building
Provo, UT 84602
Telephone: 801-422-2586

ADVISEMENT CENTER INFORMATION

Engineering Advisement Center
Brigham Young University
246 Engineering Building
Provo, UT 84602
Telephone: 801-422-4325
Email: engineering_advisement@byu.edu