2021 - 2022 Major Map
Chemical Engineering, BSE

School/College: Ira A. Fulton Schools of Engineering
Location: Tempe campus
ESCHEBSE

<table>
<thead>
<tr>
<th>Term 1 0 - 16 Credit Hours</th>
<th>Critical course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 113: General Chemistry I (SQ)</td>
<td></td>
<td>4</td>
<td>C</td>
<td>• ASU 101 or college specific equivalent First-Year Seminar required of all first-year students.</td>
</tr>
<tr>
<td>FSE 100: Introduction to Engineering</td>
<td></td>
<td>2</td>
<td>C</td>
<td>• FSE 100 required for first-year students and should be completed the first semester. Non-first-year students: see advisor for petitioning replacement electives.</td>
</tr>
<tr>
<td>MAT 265: Calculus for Engineers I (MA)</td>
<td>ASU 101-CHE: The ASU Experience</td>
<td>3</td>
<td>C</td>
<td>• If ENG 105 is taken, a 3 hour applicable elective must also be taken prior to graduation. See advisor.</td>
</tr>
<tr>
<td>ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition</td>
<td>Humanities, Arts and Design (HU) AND Cultural Diversity in the U.S. (C)</td>
<td>3</td>
<td></td>
<td>• Prep for success using the First-Year Student Guide.</td>
</tr>
</tbody>
</table>

Minimum 2.00 GPA ASU Cumulative.

Term hours subtotal: 16

<table>
<thead>
<tr>
<th>Term 2 16 - 30 Credit Hours</th>
<th>Critical course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 116: General Chemistry II (SQ)</td>
<td></td>
<td>4</td>
<td>C</td>
<td>• Create a Handshake profile.</td>
</tr>
<tr>
<td>MAT 266: Calculus for Engineers II (MA)</td>
<td></td>
<td>3</td>
<td>C</td>
<td>• Get involved with EPICS, the Generator Labs, and the Fulton Start-Up Center.</td>
</tr>
<tr>
<td>PHY 121: University Physics I: Mechanics (SQ)</td>
<td></td>
<td>3</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>PHY 122: University Physics Laboratory I (SQ)</td>
<td></td>
<td>1</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition</td>
<td></td>
<td>3</td>
<td>C</td>
<td></td>
</tr>
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Minimum 2.00 GPA ASU Cumulative.

Term hours subtotal: 14

<table>
<thead>
<tr>
<th>Term 3 30 - 45 Credit Hours</th>
<th>Critical course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 211: Introduction to Chemical Processing</td>
<td></td>
<td>3</td>
<td>C</td>
<td>• For more information about Bioscience Elective course options, please visit here.</td>
</tr>
<tr>
<td>MAT 242: Elementary Linear Algebra</td>
<td></td>
<td>2</td>
<td>C</td>
<td>• Prep for success using the Sophomore Guide.</td>
</tr>
<tr>
<td>MAT 267: Calculus for Engineers III (MA)</td>
<td></td>
<td>3</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CHM 233: General Organic Chemistry I</td>
<td>Bioscience Elective</td>
<td>3</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CHM 237: General Organic Chemistry Laboratory I</td>
<td></td>
<td>1</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>
Minimum 2.00 GPA ASU Cumulative.

Complete Mathematics (MA) requirement.

<table>
<thead>
<tr>
<th>Term 4 45 - 60 Credit Hours</th>
<th>Critical course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 231: Introduction to Transport Phenomena I: Fluids</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• For more information about the Engineering Elective, please visit here.</td>
</tr>
<tr>
<td>MAT 275: Modern Differential Equations (MA)</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Pursue an undergraduate research experience.</td>
</tr>
<tr>
<td>PHY 131: University Physics II: Electricity and Magnetism (SQ)</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Apply for internships.</td>
</tr>
<tr>
<td>CHM 234: General Organic Chemistry II</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Attend career fairs and events.</td>
</tr>
<tr>
<td>Engineering Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
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Term hours subtotal: 15

<table>
<thead>
<tr>
<th>Term 5 60 - 75 Credit Hours</th>
<th>Necessary course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 334: Introduction to Transport Phenomena II: Heat and Mass Transfer</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• For more information about the Upper Division Advanced Chemistry/Biochemistry Technical Elective, please visit here.</td>
</tr>
<tr>
<td>CHE 342: Introduction to Applied Chemical Thermodynamics</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Plan for success using the Junior Guide.</td>
</tr>
<tr>
<td>CHE 384: Numerical Methods for Chemical Engineers (CS)</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Network at student organization competitions or professional societies.</td>
</tr>
<tr>
<td>Upper Division Advanced Chemistry/Biochemistry Technical Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social-Behavioral Sciences (SB) AND Historical Awareness (H)</td>
<td>3</td>
<td></td>
<td></td>
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Term hours subtotal: 15

<table>
<thead>
<tr>
<th>Term 6 75 - 90 Credit Hours</th>
<th>Necessary course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 433: Modern Separations</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Research and prepare for graduate school.</td>
</tr>
<tr>
<td>CHE 442: Introduction to Chemical Reactor Design</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Apply for an engineering 4+1 program.</td>
</tr>
<tr>
<td>CHE 352: Chemical Engineering Lab I (L)</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• Develop a professional profile online.</td>
</tr>
<tr>
<td>IEE 220: Business and Industrial Engineering</td>
<td>3</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social-Behavioral Sciences (SB) AND Global Awareness (G)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).</td>
<td></td>
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Term hours subtotal: 15

<table>
<thead>
<tr>
<th>Term 7 90 - 105 Credit Hours</th>
<th>Necessary course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 432: Principles of Chemical Engineering Design</td>
<td>3</td>
<td>C</td>
<td></td>
<td>• For more information about Upper Division CHE Technical Electives, please visit here.</td>
</tr>
<tr>
<td>CHE 451: Chemical Engineering Laboratory II</td>
<td>3</td>
<td></td>
<td></td>
<td>• Plan for success using the Senior Guide.</td>
</tr>
<tr>
<td>CHE 461: Process Dynamic Control (CS)</td>
<td>3</td>
<td></td>
<td></td>
<td>• Use Handshake to apply for full-time positions.</td>
</tr>
<tr>
<td>Upper Division CHE Technical Elective</td>
<td>3</td>
<td></td>
<td></td>
<td>• Complete an in person or virtual practice interview.</td>
</tr>
<tr>
<td>Humanities, Arts and Design (HU)</td>
<td>3</td>
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<td></td>
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</table>

Term hours subtotal: 15

<table>
<thead>
<tr>
<th>Term 8 105 - 120 Credit Hours</th>
<th>Necessary course signified by</th>
<th>Hours</th>
<th>Minimum Grade</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 462: Process Design (L)</td>
<td>3</td>
<td></td>
<td></td>
<td>• For more information about Upper Division Advanced Chemistry/Biochemistry Technical Electives, Upper Division CHE Technical Electives, and Upper Division Natural Science or Materials Science Technical Electives.</td>
</tr>
<tr>
<td>Upper Division Advanced Chemistry/Biochemistry Technical Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Division CHE Technical Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Division Natural Science or Materials Science Technical Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For a list of Engineering Electives, Upper Division Advanced Chemistry/Biochemistry Technical Electives, CHE Upper Division Technical Electives, and Upper Division Natural Science or MSE Technical Elective course options please visit: CHE Elective Course Options.

### Bioscience Electives
- BIO 181: General Biology I (SQ)
- BIO 182: General Biology II (SG)
- BIO 201: Human Anatomy and Physiology I (SG)
- BIO 202: Human Anatomy and Physiology II (SG)
- BME 111: Engineering Perspectives on Biological Systems
- MIC 205: Microbiology (SG)
- MIC 220: Biology of Microorganisms

### Engineering Elective
- BME 235: Physiology for Engineers
- BME 494: Bioenergy and Microbial Biotechnology
- BME 494: Biomedical Device Design
- BME 494: Finite Element Modeling for Biomedical Application
- BME 494: Molecular Medicine
- BME 494: Molecular Synthetic Biology
- CEE 210: Engineering Mechanics I: Statics
- CEE 400: Earth Systems Engineering and Management ((L or HU) & H)
- CEE 494: Sustainable Energy and Material Use
- CSE 205: Object-Oriented Programming and Data Structures (CS)
- EEE 202: Circuits I
- EEE 241: Fundamentals of Electromagnetics
- EEE 498: Manufacturing Science of Solar Cells
- EGR 494: Engineering in Semiconductors and Microelectronics
- FSE 301: Entrepreneurship and Value Creation
- FSE 394: Engineering in Global Context
- IEE 300: Economic Analysis for Engineers
- IEE 380: Probability and Statistics for Engineering Problem Solving (CS)
- IEE 385: Engineering Statistics: Probability
- MSE 250: Structure and Properties of Materials
- MSE 460: Nanomaterials in Energy Production and Storage
- MSE 494: Bioinspired Materials and Biomaterials

### Upper Division CHE Technical Electives
- CHE ** Elective
- By approval only:
  - CHE 484: Internship
  - CHE 492: Honors Directed Study
  - CHE 493: Honors Thesis (L)
  - CHE 499: Individualized Instruction

### Upper Division Humanities, Arts and Design (HU) OR Upper Division Social-Behavioral Sciences (SB)

| Term hours subtotal: | 15 |

For a list of Engineering Electives, Upper Division Advanced Chemistry/Biochemistry Technical Electives, CHE Upper Division Technical Electives, and Upper Division Natural Science or MSE Technical Elective course options please visit: CHE Elective Course Options.
MSE 494: Electrochemical Materials Science
MSE 494: Failure Analysis of Metallic Materials
MSE 494: Introduction to Computational Materials
MSE 494: Manufacturing Processes for Structural Materials
Note: MSE 208, 301, or 308 cannot be used.
Note: Students taking IEE 380 or IEE 385 cannot take STP 420 or STP 421 for Natural Science/Materials Elective.

Upper Division Advanced Chemistry/Biochemistry Technical Elective
BCH 341: Physical Chemistry with a Biological Focus
BCH 361: Advanced Principles of Biochemistry
BCH 461: General Biochemistry
BCH 463: Biophysical Chemistry
BCH 494: Chemical Biology
BCH 494: Protein Biochemistry
CHM 302: Environmental Chemistry
CHM 325: Analytical Chemistry or CHM 341: Elementary Physical Chemistry or CHM 345: Physical Chemistry I
CHM 433: Advanced Organic Chemistry I
CHM 435: Medicinal Chemistry
CHM 453: Inorganic Chemistry
CHM 471: Solid-State Chemistry
CHM 481: Geochemistry
CHM 494: Bioinorganic
CHM 494: Chemistry of Atmospheres
CHM 494: Thermodynamics of Natural Systems

Upper Division Natural Science or Materials Science Technical Electives
BCH 494: Bioenergy and Microbial Biotechnology
BCH 494: Chemical Biology
BCH 494: Protein Biochemistry
BIO 302: Cancer—Mother of All Diseases (L)
BCH 494: Bioenergy and Microbial Biotechnology
BCH 494: Protein Biochemistry
BIO 320: Fundamentals of Ecology
BIO 325: Oceanography
BIO 340: General Genetics
BIO 353: Cell Biology
BIO 494: Environmental Systems Biology
BME 494: Bioenergy and Microbial Biotechnology
BME 494: Biomedical Device Design
BME 494: Finite Element Modeling for Biomedical Application
BME 494: Molecular Medicine
BME 494: Molecular Synthetic Biology
CEE 494: Sustainable Energy and Material Use
EEE 352: Properties of Electronic Materials
EEE 435: Fundamentals of CMOS and MEMS
EEE 436: Fundamentals of Solid-State Devices
EEE 460: Nuclear Power Engineering
EEE 463: Electrical Power Plants
EEE 465: Photovoltaic Energy Conversion
EEE 498: Manufacturing Science of Solar Cells
GLG 321: Mineralogy
GLG 418: Geophysics
GLG 419: Geodynamics
GLG 481: Geochemistry
GLG 494: Environmental Systems Biology
MAE 404: Finite Elements in Engineering
MBB 347: Molecular Genetics: From Genes to Proteins
MIC 360: Bacterial Physiology
MIC 420: Immunology: Molecular and Cellular Foundations
MIC 441: Bacterial Genetics
MIC 445: Techniques in Molecular Biology/Genetics
MIC 461: Geomicrobiology
MSE 355: Structure and Defects
MSE 457: Quantum Mechanics for Understanding Properties of Atoms and Solids
MSE 460: Nanomaterials in Energy Production and Storage
MSE 494: Bioinspired Materials and Biomaterials
MSE 494: Composite Materials
MSE 494: Electrochemical Materials Science
MSE 494: Failure Analysis of Metallic Materials
MSE 494: Introduction to Computational Materials
MSE 494: Manufacturing Processes for Structural Materials
PHY 312: Mechanics and Electromagnetism
PHY 331: Principles of Modern Electromagnetism
PHY 361: Introductory Modern Physics
PHY 494: Introduction to Nanoscience
STP 420: Introductory Applied Statistics (CS)

Notes:

- First-Year Composition: All students are placed in ENG 101 unless submission of SAT, ACT, Accuplacer, IELTS, or TOEFL score, or college-level transfer credit or test credit equivalent to ASU's first-year composition course(s), determine otherwise. Students on Polytechnic, Downtown
Phoenix and West Campuses are encouraged to complete the Directed Self-Placement survey to choose the first-year composition option they believe best suits their needs. Visit: https://cisa.asu.edu/DSP

- Mathematics Placement Assessment score determines placement in first mathematics course.

**Total Hours:** 120  
**Upper Division Hours:** 45 minimum  
**Major GPA:** 2.00 minimum  
**Cumulative GPA:** 2.00 minimum  
**Total hrs at ASU:** 30 minimum  
**Hrs Resident Credit for Academic Recognition:** 56 minimum  
**Total Community College Hrs:** 64 maximum

**General University Requirements Legend**

**General Studies Core Requirements:**
- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Arts and Design (HU)
- Social-Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

**General Studies Awareness Requirements:**
- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

**First-Year Composition**

General Studies designations listed on the major map are current for the 2021 - 2022 academic year.