

# MAJOR IN CHEMICAL AND BIOLOGICAL ENGINEERING, ADVANCED MATERIALS CONCENTRATION

## Distinctive Requirements for Degree Program:

**TO PREPARE FOR FIRST SEMESTER:** The curriculum for this major assumes students enter college prepared to take calculus.

## Major Completion Map

Students may enroll in either the standalone major or (at most) one of the concentrations under the Major in Chemical and Biological Engineering.

### Freshman

| Semester 1           |                                                                                                                                                                                                   | Critical | Recommended | AUCC | Credits   |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|------|-----------|
| CHEM 120             | Foundations of Modern Chemistry (GT-SC2)                                                                                                                                                          | X        |             | 3A   | 4         |
| CHEM 121             | Foundations of Modern Chemistry Laboratory (GT-SC1)                                                                                                                                               | X        |             | 3A   | 1         |
| CO 150               | College Composition (GT-CO2)                                                                                                                                                                      |          | X           | 1A   | 3         |
| ENGR 111             | Fundamentals of Engineering                                                                                                                                                                       | X        |             |      | 3         |
| MATH 160             | Calculus for Physical Scientists I (GT-MA1)                                                                                                                                                       | X        |             | 1B   | 4         |
| <b>Total Credits</b> |                                                                                                                                                                                                   |          |             |      | <b>15</b> |
| Semester 2           |                                                                                                                                                                                                   | Critical | Recommended | AUCC | Credits   |
| ENGR 114             | Engineering for Grand Challenges                                                                                                                                                                  | X        |             |      | 3         |
| LIFE 102             | Attributes of Living Systems (GT-SC1)                                                                                                                                                             | X        |             | 3A   | 4         |
| MATH 161             | Calculus for Physical Scientists II (GT-MA1)                                                                                                                                                      | X        |             | 1B   | 4         |
| 1C                   | ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc</a> ) |          | X           | 1C   | 3         |
| <b>Total Credits</b> |                                                                                                                                                                                                   |          |             |      | <b>14</b> |

### Sophomore

| Semester 3           |                                                                                                                                                                                                                         | Critical | Recommended | AUCC | Credits   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|------|-----------|
| CBE 201              | Material and Energy Balances                                                                                                                                                                                            | X        |             |      | 3         |
| CBE 205/<br>BIOM 205 | Biological and Cellular Engineering                                                                                                                                                                                     | X        |             |      | 3         |
| MATH 261             | Calculus for Physical Scientists III                                                                                                                                                                                    | X        |             |      | 4         |
| PH 141               | Physics for Scientists and Engineers I (GT-SC1)                                                                                                                                                                         | X        |             | 3A   | 5         |
| Arts and Humanities  | ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> ) |          | X           | 3B   | 3         |
| <b>Total Credits</b> |                                                                                                                                                                                                                         |          |             |      | <b>18</b> |
| Semester 4           |                                                                                                                                                                                                                         | Critical | Recommended | AUCC | Credits   |
| CBE 210              | Thermodynamic Process Analysis                                                                                                                                                                                          | X        |             |      | 3         |
| CBE 223              | CBE Design and Experimentation I                                                                                                                                                                                        | X        |             |      | 2         |
| CBE 393              | Professional Development Seminar                                                                                                                                                                                        |          | X           |      | 1         |
| CHEM 241             | Foundations of Organic Chemistry                                                                                                                                                                                        | X        |             |      | 4         |
| CHEM 242             | Foundations of Organic Chemistry Laboratory                                                                                                                                                                             | X        |             |      | 1         |
| MATH 340             | Intro to Ordinary Differential Equations                                                                                                                                                                                | X        |             |      | 4         |
| <b>Total Credits</b> |                                                                                                                                                                                                                         |          |             |      | <b>15</b> |

### Junior

| Semester 5          |                                              | Critical | Recommended | AUCC | Credits |
|---------------------|----------------------------------------------|----------|-------------|------|---------|
| CBE 320             | Chemical and Biological Reactor Design       | X        |             |      | 3       |
| CBE 330             | Process Simulation                           | X        |             |      | 3       |
| CBE 331             | Momentum Transfer and Mechanical Separations | X        |             |      | 3       |
| CBE 334             | CBE Design and Experimentation II            | X        |             |      | 1       |
| Bioscience Elective |                                              |          | X           |      | 3       |

|                                                                                                                                                                                                                                                                              |                                                            |                 |                    |             |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------|--------------------|-------------|----------------|
| Chemistry Elective                                                                                                                                                                                                                                                           |                                                            |                 | X                  |             | 3              |
| <b>Total Credits</b>                                                                                                                                                                                                                                                         |                                                            |                 |                    |             | <b>16</b>      |
| <b>Semester 6</b>                                                                                                                                                                                                                                                            |                                                            | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| BC 351 or CHEM 321                                                                                                                                                                                                                                                           | Principles of Biochemistry Foundations of Chemical Biology |                 | X                  |             | 4              |
| CBE 332                                                                                                                                                                                                                                                                      | Heat and Mass Transfer Fundamentals                        | X               |                    |             | 3              |
| CBE 335                                                                                                                                                                                                                                                                      | CBE Design and Experimentation III                         | X               |                    |             | 1              |
| CBE 340                                                                                                                                                                                                                                                                      | Statistics for CBE Applications                            | X               |                    |             | 3              |
| Chemistry Elective                                                                                                                                                                                                                                                           |                                                            |                 | X                  |             | 3              |
| Historical Perspectives ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> )              |                                                            |                 | X                  | 3D          | 3              |
| <b>Total Credits</b>                                                                                                                                                                                                                                                         |                                                            |                 |                    |             | <b>17</b>      |
| <b>Senior</b>                                                                                                                                                                                                                                                                |                                                            |                 |                    |             |                |
| <b>Semester 7</b>                                                                                                                                                                                                                                                            |                                                            | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| CBE 442                                                                                                                                                                                                                                                                      | Separation Processes                                       | X               |                    |             | 4              |
| CBE 443                                                                                                                                                                                                                                                                      | Chemical and Biological Engineering Lab II                 | X               |                    |             | 2              |
| CBE 451                                                                                                                                                                                                                                                                      | Chemical and Biological Engineering Design I               | X               |                    | 4A,4B,4C    | 3              |
| Technical Elective                                                                                                                                                                                                                                                           |                                                            |                 | X                  |             | 3              |
| Advanced Writing ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing</a> )                                   |                                                            |                 | X                  | 2           | 3              |
| Arts and Humanities ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )                                  |                                                            |                 | X                  | 3B          | 3              |
| <b>Total Credits</b>                                                                                                                                                                                                                                                         |                                                            |                 |                    |             | <b>18</b>      |
| <b>Semester 8</b>                                                                                                                                                                                                                                                            |                                                            | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| CBE 430                                                                                                                                                                                                                                                                      | Process Control and Instrumentation                        | X               |                    |             | 3              |
| CBE 452                                                                                                                                                                                                                                                                      | Chemical and Biological Engineering Design II              | X               |                    | 4A,4B,4C    | 3              |
| Technical Electives                                                                                                                                                                                                                                                          |                                                            | X               |                    |             | 6              |
| Social and Behavioral Sciences ( <a href="https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences">https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences</a> ) |                                                            |                 | X                  | 3C          | 3              |
| The benchmark courses for the 8th semester are the remaining courses in the entire program of study.                                                                                                                                                                         |                                                            | X               |                    |             |                |
| <b>Total Credits</b>                                                                                                                                                                                                                                                         |                                                            |                 |                    |             | <b>15</b>      |
| <b>Program Total Credits:</b>                                                                                                                                                                                                                                                |                                                            |                 |                    |             | <b>128</b>     |