

# DUAL DEGREE PROGRAM: BIOMEDICAL ENGINEERING COMBINED WITH ELECTRICAL ENGINEERING, LASERS AND OPTICAL ENGINEERING CONCENTRATION

## Major Completion Map

### Distinctive Requirements for Degree Program:

**TO DECLARE MAJOR:** Engineering is a controlled major: students are admitted into the major only if they meet established academic

standards. Please see competitive major requirements or the advisor in the department for more information.

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

To qualify for graduation, students in the biomedical engineering combined with chemical and biological engineering program must achieve a minimum 2.000 grade point average at CSU in all courses in engineering, mathematics, computer science, statistics, physics, and chemistry as well as courses taken as technical electives.

**In order to maintain professional standards required of practicing engineers, the Department of Electrical and Computer Engineering requires a cumulative grade point average of at least 2.000 in ECE courses as a graduation requirement. It is the responsibility of any student who fails to maintain a 2.000 average to work with their advisor to correct grade point deficiencies. In addition, it is required that students retake any Electrical Engineering course at the 300-level or below in which they receive a grade below a C (2.000).**

### Freshman

| Semester 1           |   | Critical | Recommended | AUCC | Credits   |
|----------------------|---|----------|-------------|------|-----------|
| BIOM 100             | Overview of Biomedical Engineering          | X        |             |      | 1         |
| CHEM 111             | General Chemistry I (GT-SC2)                | X        |             | 3A   | 4         |
| CO 150               | College Composition (GT-CO2)                |          | X           | 1A   | 3         |
| ECE 102              | Digital Circuit Logic                       | X        |             |      | 4         |
| MATH 160             | Calculus for Physical Scientists I (GT-MA1) | X        |             | 1B   | 4         |
| <b>Total Credits</b> |   |          |             |      | <b>16</b> |

| Semester 2           |   | Critical | Recommended | AUCC | Credits   |
|----------------------|---|----------|-------------|------|-----------|
| ECE 103              | DC Circuit Analysis                             | 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         |
| PH 141               | Physics for Scientists and Engineers I (GT-SC1) | X        |             | 3A   | 5         |
| <b>Total Credits</b> |   |          |             |      | <b>16</b> |

### Sophomore

| Semester 3                               |  | Critical | Recommended | AUCC  | Credits      |
|--|--|----------|-------------|-------|--------------|
| BIOM 200                                 | Fundamentals of Biomedical Engineering           | X        |             |       | 2            |
| CHEM 112                                 | General Chemistry Lab I (GT-SC1)                 |          | X           | 3A    | 1            |
| Select from one of the following groups: |  | X        |             |       | 3-4          |
| Group A                                  |  |          |             |       |              |
| CS 150B                                  | Culture and Coding: Python (GT-AH3)              | X        |             | 3B,3B |              |
| Group B                                  |  |          |             |       |              |
| CS 152                                   | Python for STEM                                  | X        |             |       |              |
| CS 162                                   | CS1--Introduction to Java Programming            | X        |             |       |              |
| Group C                                  |  |          |             |       |              |
| CS 163                                   | CS1--No Prior Programming Experience             | X        |             |       |              |
| MATH 261                                 | Calculus for Physical Scientists III             | X        |             |       | 4            |
| PH 142                                   | Physics for Scientists and Engineers II (GT-SC1) | X        |             | 3A    | 5            |
| <b>Total Credits</b>                     |  |          |             |       | <b>15-16</b> |

| Semester 4           |  | Critical | Recommended | AUCC | Credits |
|----------------------|--|----------|-------------|------|---------|
| ECE 202              | Circuit Theory Applications                      | X        |             |      | 4       |
| ECE 232              | Introduction to Project Practices                | X        |             |      | 1       |
| ECE 303/<br>STAT 303 | <b>Introduction to Communications Principles</b> | X        |             |      | 3       |
| MATH 340             | Intro to Ordinary Differential Equations         | X        |             |      | 4       |

|   |   |  |                 |                    |             |                |
|---|---|--|-----------------|--------------------|-------------|----------------|
| PH 314  | Introduction to Modern Physics                  |  | X               |                    |             | 4              |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>16</b>      |
| <b>Junior</b>   |   |  |                 |                    |             |                |
| <b>Semester 5</b>   |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| ECE 311   | Linear System Analysis I                        |  | X               |                    |             | 3              |
| ECE 331   | Electronics Principles I                        |  | X               |                    |             | 4              |
| ECE 341   | Electromagnetic Fields and Devices I            |  | X               |                    |             | 3              |
| Select from the following to complete group sequence:   |   |  | X               |                    |             | 3-4            |
| Group A   |   |  |                 |                    |             |                |
| CS 164  | CS1–Computational Thinking with Java            |  | X               |                    |             |                |
| Group B   |   |  |                 |                    |             |                |
| Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> ) |   |  | X               |                    | 3B          |                |
| Group C   |   |  |                 |                    |             |                |
| Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> ) |   |  | X               |                    | 3B          |                |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>13-14</b>   |
| <b>Semester 6</b>   |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| BIOM 300  | Problem-Based Learning Biomedical Engr Lab      |  | X               |                    |             | 4              |
| BMS 300   | Principles of Human Physiology                  |  |                 | X                  |             | 4              |
| ECE 332   | Electronics Principles II                       |  | X               |                    |             | 4              |
| ECE 342   | Electromagnetic Fields and Devices II           |  | X               |                    |             | 3              |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>15</b>      |
| <b>Senior</b>   |   |  |                 |                    |             |                |
| <b>Semester 7</b>   |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| CHEM 113  | General Chemistry II                            |  |                 | X                  |             | 3              |
| ECE 404   | Experiments in Optical Electronics              |  | X               |                    |             | 2              |
| ECE 441   | Optical Electronics                             |  | X               |                    |             | 3              |
| MECH 337  | Thermodynamics                                  |  |                 | X                  |             | 4              |
| PH 353  | Optics and Waves                                |  | X               |                    |             | 4              |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>16</b>      |
| <b>Semester 8</b>   |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| <b>BIOM 431/<br/>ECE 431</b>  | <b>Biomedical Signal and Image Processing</b>   |  | <b>X</b>        |                    |             | <b>3</b>       |
| CHEM 245  | Fundamentals of Organic Chemistry               |  |                 | X                  |             | 4              |
| ECE 457   | Fourier Optics                                  |  | X               |                    |             | 3              |
| ECON 202  | Principles of Microeconomics (GT-SS1)           |  |                 | X                  | 3C          | 3              |
| MECH 262  | Engineering Mechanics                           |  | X               |                    |             | 4              |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>17</b>      |
| <b>Fifth Year</b>   |   |  |                 |                    |             |                |
| <b>Semester 9</b>   |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| BIOM 486A   | Biomedical Design Practicum: Capstone Design I  |  | X               |                    | 4A,4B,4C    | 4              |
| PH 451  | Introductory Quantum Mechanics I                |  | X               |                    |             | 3              |
| Select one course from the following:   |   |  |                 | X                  |             | 3              |
| CO 301B   | Writing in the Disciplines: Sciences (GT-C03)   |  |                 |                    | 2           |                |
| JTC 300   | Strategic Writing and Communication (GT-C03)    |  |                 | X                  | 2           |                |
| ECE Lasers & Optical Engineering Technical Electives (See List on Requirements tab)   |   |  |                 | X                  |             | 4              |
| 1C ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc</a> )  |   |  |                 | X                  | 1C          | 3              |
| <b>Total Credits</b>  |   |  |                 |                    |             | <b>17</b>      |
| <b>Semester 10</b>  |   |  | <b>Critical</b> | <b>Recommended</b> | <b>AUCC</b> | <b>Credits</b> |
| BIOM 486B   | Biomedical Design Practicum: Capstone Design II |  | X               |                    | 4A,4B,4C    | 4              |

|   |   |    |                |
|---|---|----|----------------|
| BME Broad Elective (See List on Requirements Tab)   | X |    | 3              |
| ECE Lasers & Optical Engineering Technical Electives (See List on Requirements tab)   | X |    | 4              |
| Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )                     | X | 3B | 3              |
| Historical Perspectives ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> ) | X | 3D | 3              |
| The benchmark courses for the 10th semester are the remaining courses in the entire program of study.   | X |    |                |
| <b>Total Credits</b>  |   |    | <b>17</b>      |
| <b>Program Total Credits:</b>   |   |    | <b>158-160</b> |