

# BIOLOGICAL SYSTEMS ENGINEERING, BS

## REQUIREMENTS

### UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (<https://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext>) section of the Guide.

- |                   |  |
|-------------------|--|
| General Education | <ul style="list-style-type: none"> <li>• Breadth–Humanities/Literature/Arts: 6 credits</li> <li>• Breadth–Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits</li> <li>• Breadth–Social Studies: 3 credits</li> <li>• Communication Part A &amp; Part B *</li> <li>• Ethnic Studies *</li> <li>• Quantitative Reasoning Part A &amp; Part B *</li> </ul> |
|-------------------|--|

\* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

### COLLEGE OF AGRICULTURAL AND LIFE SCIENCES REQUIREMENTS

In addition to the University General Education Requirements, all undergraduate students in CALS must satisfy a set of college and major requirements. Courses may not double count within university requirements (General Education and Breadth) or within college requirements (First-Year Seminar, International Studies, Science, and Capstone), but courses counted toward university requirements may also be used to satisfy a college and/or a major requirement; similarly, courses counted toward college requirements may also be used to satisfy a university and/or a major requirement.

### COLLEGE REQUIREMENTS FOR ALL CALS BS DEGREE PROGRAMS

| Code | Title | Credits |
|------|-------|---------|
|------|-------|---------|

Quality of Work: Students must maintain a minimum cumulative grade point average of 2.000 to remain in good standing and be eligible for graduation.

|  |                            |     |
|--|----------------------------|-----|
| Residency: Students must complete 30 degree credits in residence at UW–Madison after earning 86 credits toward their undergraduate degree.   |                            |     |
| First year seminar ( <a href="https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSThirdYearSeminarCourses">https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSThirdYearSeminarCourses</a> )   |                            | 1   |
| International studies ( <a href="https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSThirdYearSeminarCourses">https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSThirdYearSeminarCourses</a> )  |                            | 3   |
| Physical science fundamentals  |                            | 4-5 |
| CHEM 103   | General Chemistry I        |     |
| or CHEM 108  | Chemistry in Our World     |     |
| or CHEM 109  | Advanced General Chemistry |     |
| Biological science   |                            | 5   |
| Additional science (biological, physical, or natural)  |                            | 3   |
| Science breadth (biological, physical, natural, or social)   |                            | 3   |
| CALS Capstone Learning Experience: included in the requirements for each CALS major (see "major requirements") ( <a href="https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSCapstoneRequirement">https://guide.wisc.edu/undergraduate/agricultural-life-sciences/#CALSCapstoneRequirement</a> ) |                            |     |

### NAMED OPTIONS WITHIN THE MAJOR

Students may complete the Biological Systems Engineering General Program or select a Named Option. The course requirements on this page represent the general program. Students are encouraged to consider one of the Named Options (Food and Bioprocess Engineering; Machinery Systems Engineering; or Natural Resources and Environmental Engineering). Links to learn more about these options, including the course requirements, are included below.

View as listView as grid

- **BIOLOGICAL SYSTEMS ENGINEERING: FOOD AND BIOPROCESS ENGINEERING (HTTPS://GUIDE.WISC.EDU/ UNDERGRADUATE/AGRICULTURAL-LIFE-SCIENCES/BIOLOGICAL-SYSTEMS-ENGINEERING/BIOLOGICAL-SYSTEMS-ENGINEERING-BS/BIOLOGICAL-SYSTEMS-ENGINEERING-FOOD-BIOPROCESS-ENGINEERING-BS/)**
- **BIOLOGICAL SYSTEMS ENGINEERING: MACHINERY SYSTEMS ENGINEERING (HTTPS://GUIDE.WISC.EDU/ UNDERGRADUATE/AGRICULTURAL-LIFE-SCIENCES/BIOLOGICAL-SYSTEMS-ENGINEERING/BIOLOGICAL-SYSTEMS-ENGINEERING-BS/BIOLOGICAL-SYSTEMS-ENGINEERING-MACHINERY-SYSTEMS-ENGINEERING-BS/)**
- **BIOLOGICAL SYSTEMS ENGINEERING: NATURAL RESOURCES AND ENVIRONMENTAL ENGINEERING (HTTPS://GUIDE.WISC.EDU/ UNDERGRADUATE/AGRICULTURAL-LIFE-SCIENCES/BIOLOGICAL-SYSTEMS-ENGINEERING/BIOLOGICAL-SYSTEMS-ENGINEERING-BS/BIOLOGICAL-SYSTEMS-ENGINEERING-NATURAL-RESOURCES-ENVIRONMENTAL-ENGINEERING-BS/)**

## MAJOR REQUIREMENTS

| Code  | Title | Credits    |
|---|-------|------------|
| <b>Major Requirements</b>                       |       |            |
| Common Requirements                             |       | 53         |
| General Program Classes and Technical Electives |       | 43         |
| Capstone  |       | 5          |
| <b>Total Credits</b>                            |       | <b>101</b> |

## COMMON REQUIREMENTS

The Biological Systems Engineering program requires completion of a minimum of 125 credits to be eligible for graduation. Note that this is higher than the minimum for other CALS programs.

| Code                              | Title   | Credits |
|-----------------------------------|---|---------|
| <b>Mathematics and Statistics</b> |   |         |
| MATH 221                          | Calculus and Analytic Geometry 1              | 5       |
| MATH 222                          | Calculus and Analytic Geometry 2              | 4       |
| MATH 234                          | Calculus--Functions of Several Variables      | 4       |
| MATH 319                          | Techniques in Ordinary Differential Equations | 3       |
| or MATH 320                       | Linear Algebra and Differential Equations     |         |

|          |  |   |
|----------|--|---|
| STAT 324 | Introduction to Statistics for Science and Engineering | 3 |
|----------|--|---|

### Chemistry

Complete one of the following: 5-9

|                     |   |  |
|---------------------|---|--|
| CHEM 109            | Advanced General Chemistry (Recommended)                  |  |
| CHEM 103 & CHEM 104 | General Chemistry I and General Chemistry II <sup>1</sup> |  |

### Biology

|         |  |   |
|---------|--|---|
| BSE 349 | Quantitative Techniques for Biological Systems | 3 |
|---------|--|---|

Complete one additional Biological Science Breadth Course; the following courses are preferred choices:<sup>2</sup> 2-5

|                              |   |  |
|------------------------------|---|--|
| BIOLOGY/ BOTANY/ ZOOLOGY 151 | Introductory Biology                                      |  |
| ZOOLOGY 153                  | Introductory Biology                                      |  |
| BIOLOGY/ BOTANY 130          | General Botany  |  |
| BIOLOGY/ ZOOLOGY 101         | Animal Biology  |  |
| AN SCI/ DY SCI 101           | Introduction to Animal Sciences <sup>2</sup>              |  |
| MICROBIO 101                 | General Microbiology <sup>3</sup>                         |  |
| MICROBIO 303                 | Biology of Microorganisms <sup>3</sup>                    |  |
| PLANTSCI 110                 | Introduction to Plant Science and Technology <sup>2</sup> |  |

### Physics

|             |                      |   |
|-------------|----------------------|---|
| E M A 201   | Statics <sup>4</sup> | 3 |
| PHYSICS 202 | General Physics      | 5 |

### Foundation

|               |  |   |
|---------------|--|---|
| BSE 270       | Introduction to Computer Aided Design                            | 3 |
| BSE 380       | Introductory Data Science for the Agricultural and Life Sciences | 3 |
| BSE 310       | Project Economics & Decision Analysis (preferred)                | 3 |
| or I SY E 313 | Engineering Economic Analysis                                    |   |

### Core

|            |  |   |
|------------|--|---|
| BSE 249    | Engineering Principles for Biological Systems <sup>5</sup> | 3 |
| or CBE 250 | Process Synthesis  |   |
| BSE 365    | Measurements and Instrumentation for Biological Systems    | 3 |
| BSE 308    | Career Management for Engineers                            | 1 |

**Total Credits 53-60**

<sup>1</sup> Taking the combination of CHEM 103 and CHEM 104 instead of CHEM 109 may increase the total minimum number of credits required to complete the program.

<sup>2</sup> Machinery Systems students may select AN SCI/DY SCI 101 or PLANTSCI 110 to also satisfy the Machinery Systems Production Agriculture requirement. Any biological science course of 2 or more credits is accepted. Additional courses taken may be counted as Technical Electives.

<sup>3</sup> MICROBIO 101 or MICROBIO 303 required for Food & Bioprocess Engineering specialization.

<sup>4</sup> E M A 201 Statics is an acceptable prerequisite for PHYSICS 202 General Physics.

<sup>5</sup> Students selecting the Food & Bioprocess Engineering option who plan to enroll in CBE 310 Chemical Process Thermodynamics and CBE 320 Introductory Transport Phenomena must take CBE 250 here as a prerequisite. Students selecting the Food & Bioprocess Engineering option who plan to enroll in M E 361 Thermodynamics and M E 363 Fluid Dynamics are recommended to take BSE 249 here.

## GENERAL PROGRAM REQUIREMENTS

| Code  | Title   | Credits      |
|---|---|--------------|
| M E 361   | Thermodynamics <sup>1</sup>                               | 3            |
| or CBE 310  | Chemical Process Thermodynamics                           |              |
| BSE 464   | Heat and Mass Transfer in Biological Systems              | 3            |
| E M A 303   | Mechanics of Materials                                    | 3            |
| Complete one of the following courses: <sup>1</sup>   |   | 3-4          |
| M E 363   | Fluid Dynamics  |              |
| CIV ENGR 310  | Fluid Mechanics   |              |
| CBE 320   | Introductory Transport Phenomena                          |              |
| Complete a minimum of three of the following:   |   | 6-9          |
| BSE 301   | Land Information Management                               |              |
| BSE 364   | Engineering Properties of Food and Biological Materials   |              |
| BSE/<br>ENVIR ST 367  | Renewable Energy Systems                                  |              |
| BSE/CIV ENGR/<br>SOIL SCI 372   | On-Site Waste Water Treatment and Dispersal               |              |
| BSE 405   | Artificial Intelligence in Agriculture                    |              |
| BSE 460   | Biorefining: Energy and Products from Renewable Resources |              |
| BSE 461   | Food and Bioprocessing Operations                         |              |
| BSE 472   | Sediment and Bio-Nutrient Engineering and Management      |              |
| BSE 473   | Water Management Systems                                  |              |
| BSE/M E 475   | Engineering Principles of Agricultural Machinery          |              |
| BSE/M E 476   | Engineering Principles of Off-Road Vehicles               |              |
| M E/BSE 474   | Fluid Power   |              |
| AN SCI/BSE 344  | Digital Technologies for Animal Monitoring                |              |
| BSE 305   | Introduction to Precision Agriculture                     |              |
| BSE 571   | Small Watershed Engineering                               |              |
| Complete a minimum of 9 credits of coursework numbered 300 or above non-BSE engineering courses |   | 9            |
| <b>Total Credits</b>  |   | <b>27-31</b> |

<sup>1</sup> Take BSE 249 and M E 361 and M E 363, or take CBE 250 and CBE 310 and CBE 320.

## TECHNICAL ELECTIVES

Select courses from one or more of the following four technical elective categories to bring the total number of credits in the General Program Area or in the selected specialization area to 43.

### A. INTRODUCTION TO ENGINEERING COURSES (FIRST-YEAR STUDENTS ONLY)

| Code         | Title            | Credits |
|--------------|------------------|---------|
| INTEREGR 170 | Design Practicum | 3       |

### B. INDEPENDENT STUDY/INSTRUCTION COURSES

CALS or CoE courses with a 001, 299, 399, or 699 course number.

No more than 3 credits of coursework in this category can be used to meet technical elective requirements.

### C. UPPER-LEVEL COURSES

#### Part 1. Upper-Level Engineering Courses

This includes BSE courses not taken to meet other curricular requirements. This does not include independent study/instruction courses.

| Code   | Title    | Credits |
|--|----------|---------|
| Any Engineering course numbered 300 or above |          |         |
| E M A 202                                    | Dynamics | 3       |

#### Part 2. Upper-Level Science Courses

This includes BSE courses not taken to meet other curricular requirements. This does not include independent study/instruction courses.

| Code   | Title                                     | Credits |
|--|---|---------|
| Advanced biological, natural, and physical science courses (i.e., courses with a B, N, or P designation) |   |         |
| CHEM 341   | Elementary Organic Chemistry              | 3       |
| CHEM 342   | Elementary Organic Chemistry Laboratory   | 1       |
| CHEM 343   | Organic Chemistry I                       | 3       |
| CHEM 344   | Introductory Organic Chemistry Laboratory | 2       |
| CHEM 345   | Organic Chemistry II                      | 3       |
| CHEM/M S & E 421   | Polymeric Materials                       | 3       |
| PLANTSCI/<br>ATM OCN 532   | Environmental Biophysics                  | 3       |

### D. LOWER-LEVEL SCIENCE AND ENGINEERING COURSES, BREADTH COURSES

Elementary and intermediate biological, natural, and physical science courses except elementary and intermediate math courses; College of Engineering courses numbered 100 through 299; College of Agricultural and Life Sciences courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses cannot be counted in this category. No more than 12 credits of coursework in this category can be used to meet technical elective requirements.

## CAPSTONE

| Code                 | Title   | Credits  |
|----------------------|---|----------|
| BSE 508              | Biological Systems Engineering<br>Design Practicum I  | 2        |
| BSE 509              | Biological Systems Engineering<br>Design Practicum II | 3        |
| <b>Total Credits</b> |   | <b>5</b> |

## UNIVERSITY DEGREE REQUIREMENTS

**Total Degree** To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

**Residency** Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

**Quality of Work** Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.