Undergraduate Student Handbook

Biological Systems Engineering

Last revision: Fall 2017

Biological Systems Engineering
UNIVERSITY OF WISCONSIN–MADISON

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460 Henry Mall - Home of the BSE Department

A. Introduction

Welcome to the University of Wisconsin-Madison and the Department of Biological Systems Engineering (BSE). The faculty and staff are committed to enabling you to have an enriching, rewarding, and professional experience at UW-Madison.

This manual provides background information on the Biological Systems Engineering degree program and specific degree requirements, as well as guidance for meeting those requirements.

Students are assigned an academic advisor when they enter the department. Your advisor will counsel you on the academic requirements of the major and serve as a resource to answer other academic concerns.

Prior to registration, the Department places an academic advising hold on each student. This hold prevents the student from registering until they have met with their academic adviser. Consequently, you must contact your academic adviser at least once per semester prior to registering for next semester's classes. Your adviser will look over your proposed schedule to make sure you're on track for your chosen academic path. If your adviser approves of your course selection, they will notify the BSE Student Services Coordinator who will then remove your registration hold. If you have seen your advisor but are still unable to register, check to see which semester the hold is for, and contact the BSE Student Services Coordinator (262-3310).

The Biological Systems Engineering Department is committed to providing a stimulating education for all students. Please inform the Department Chair immediately of any barriers that create problems or limitations in the educational opportunities for you or other students in the department.

For further information about the Biological Systems Engineering major, please contact:

Douglas Reinemann, Professor and Chair, 608/262-3311, djreinem@wisc.edu

Betsy Wood, Student Services Coordinator, 608/262-3310, betsy.wood@wisc.edu

Robert Anex, Professor and Undergraduate Program Coordinator, 608/890-3839, anex@wisc.edu

B. Program Overview

Biological Systems Engineering is the application of engineering principles to biological and agricultural systems which greatly impact our food, fiber and renewable energy resources. Since biological systems engineering programs focus heavily on the protection and conservation of natural resources, it is not uncommon for them to be described as sustainable engineering programs.

Within the BSE program a student must enroll in either the *General Program* area or in one of the following three specialization areas: *Machinery Systems Engineering, Natural Resources and Environmental Engineering,* and *Food and Bioprocess Engineering*. The specialization in Food and Bioprocess Engineering is split into a Food Engineering track and a Bioprocess Engineering track. These areas are described in more detail in Section D.

Students who complete all degree requirements are awarded a *Bachelor of Science Degree in Biological Systems Engineering*. A student who completes one of the three program specializations will have the area of specialization identified on their official transcript.

The BSE program, like all undergraduate engineering programs on the UW-Madison campus, is accredited by ABET (Accreditation Board for Engineering and Technology). Accreditation by ABET is an indication of program quality and has major benefits for individuals seeking registration as a licensed professional engineer.

A UW-Madison BSE graduate may apply for licensure as a registered professional engineer once they have passed the Fundamentals of Engineering (FE) exam, obtained four years of qualifying engineering

work experience, and have passed the Professional Engineering (PE) exam. To obtain a BSE degree from UW-Madison, a student must have taken (but is not required to have passed) the FE exam. It is recommended that BSE students take the FE exam during their second last semester as an undergraduate engineer.

Job opportunities for BSE graduates remain plentiful and show no signs of decreasing given (1) the increase in world population and corresponding increasing need for food, fiber and renewable energy, (2) the measureable shortage of highly trained technical personnel in the United States, and (3) the constantly expanding emphasis on protection and conservation of natural resources.

The UW-Madison BSE program is traditionally known for its emphasis on undergraduate education which is reflected in outstanding one-on one advising and smaller class sizes.

An excellent way for students to learn about biological systems engineering is to become active in the Pre-Professional Club. The Pre-Professional club is a student branch of the American Society of Agricultural and Biological Engineers (ASABE), the national society for engineering in agricultural, food and biological systems. This is an excellent way to meet practicing engineers and to develop a professional network. Check it out and become involved. All students in the Biological Systems Engineering major are included on the Club's e-mail list and receive announcements of meetings and other activities of the Pre-Professional Club. If you do not get such messages, check with your advisor to make sure you get added to this e-mail list.

C. Mission, Objectives, and Desired Educational Outcomes

Mission

The mission of the Biological Systems Engineering Undergraduate Program is to provide a technology-advanced, biology-based engineering education that will enable students to design and implement efficient and environmentally sensitive methods of producing and processing food, fiber and renewable energy resources for an ever-increasing world population.

Program Objectives

The Biological Systems Engineering Department recognizes that our graduates will choose to use the knowledge and skills they have acquired during their undergraduate years to pursue a wide variety of career and life goals, and we encourage this diversity of paths. Whatever path graduates choose, be it a job, graduate school, or volunteer service, be it in engineering or another field, we have for our graduates the following objectives; that they will:

1. exhibit strong skills in problem solving, leadership, teamwork, and communication;
2. use these skills to contribute to their communities;
3. make thoughtful, well-informed career choices; and
4. demonstrate a continuing commitment to and interest in their own and others' education.

Desired Educational Outcomes

Upon graduation Biological Systems Engineering students are expected to have the following knowledge and skills:

1. an ability to analyze systems, components and processes. This includes:
    a. an ability to apply knowledge of mathematics, science, and engineering fundamentals,
    b. an ability to use the techniques and tools of modern engineering practice,
    c. an ability to identify, formulate, and solve engineering problems

2. an ability to create a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. an ability to formulate and conduct basic investigations such as laboratory experiments, prototype tests, field trials, computer simulations and market analyses
4. an ability to identify important resources, and to retrieve, interpret, analyze and critique information for use in solving engineering problems and conducting basic investigations
5. an ability to communicate effectively. This includes:
   a. an ability to effectively orally communicate,
   b. an ability to write in a clear, concise, grammatically correct and organized manner,
   c. an ability to document work activities and properly archive information,
   d. an ability to develop appropriate illustrations including hand sketches, computer generated drawings/graphs and pictures
6. an understanding of professional and ethical responsibility
7. an ability to function on multidisciplinary teams
8. the broad education necessary to understand and assess the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in lifelong learning
10. a knowledge of contemporary issues

D. Areas of Specialization

Within the BSE program a student must enroll in either the **General Program** area or in one of the following three specialization areas: **Machinery Systems Engineering**, **Natural Resources and Environmental Engineering**, and **Food and Bioprocess Engineering.**

Machinery Systems Engineering

Engineers in the Machinery Systems Engineering specialization work in a variety of industries applying mechanical technology and knowledge of biological systems to solve equipment-related problems. From design and construction to testing and evaluation and to sales and support, engineers in the Machinery Systems Engineering provide the technical know-how to get the job done. They work for small and large companies that produce machines and systems for agriculture, food and fiber processing, construction, mining, lawn and ground care, materials handling, and forestry and paper industries.

Natural Resources and Environmental Engineering

Engineers in the Natural Resources and Environment Engineering specialization area combine engineering with agricultural and environmental sciences to solve problems related to our environment and natural resources. Engineers in this field evaluate, design, modify, and improve erosion control and runoff systems, animal and human waste handling and treatment systems, irrigation and drainage systems, and water quality management practices. They find most career opportunities within government agencies and environmental consulting firms.

Food and Bioprocess Engineering

Food and Bioprocess engineers evaluate, design, modify, improve, and economize the processing and distribution of food, feed, fiber and energy. This growing field also includes the new world of biotechnology and bioprocessing. They work in companies large and small that are involved in one or more of the following: processing, packaging and distributing meat, poultry and seafood products; canning and freezing fruits and vegetables; producing ethanol and other fuels from biological materials; drying and storing grains and other food stuffs; designing and testing machines and instruments; sensing and controlling temperature, pressure and moisture during processing; and developing new foods and

processes.

Effective with the 2011-12 curriculum, the Food & Bioprocess Engineering Specialization was spilt into two tracks: food engineering and bioprocess engineering.

General Program Option

The General Program option is for those students who are interested in a combination of the three BSE specialization areas, and/or are interested in a specialization area outside of the identified three. Examples of others specialization areas include structural engineering, aquaculture engineering, forest engineering, and biomaterials engineering.

Students who complete the requirements of one of the three specialization areas will have that area of specialization identified on their official transcript. There is no such identification on the transcript of a student enrolled in the General Program option.

E. Entrance and Degree Requirements

Student Classification

On the UW-Madison campus, students are given a classification that identifies their general area of study, and in some cases, the level at which they are at in their intended area of study. Within the undergraduate BSE program, there are two different classifications: PAE and ABE. Students with a PAE classification are referred as to *Pre-Biological Systems Engineers.* You can not receive a degree in BSE if you have a PAE classification. In order to graduate, you must achieve the ABE classification. ABE classification is awarded once you meet minimum all requirements for "admission into the degree granting program" listed later in this Section.

Entering the BSE Program as a New Freshman

There are two ways to enter the BSE Program, as a new freshman, or as a transfer from another program either on or off-campus.

When you enter the program as a freshman, you are given a PAE classification.

Entry into the program as a freshman is controlled by the UW-Madison Office of Admissions and Recruitment. The BSE Department is not involved in, nor does it have any control over this process.

Individuals who desire a degree in Biological Systems Engineering, but are denied entry into UW-Madison as a freshman, should consider transferring into the BSE program after beginning their college education elsewhere.

Transferring into the BSE Program

Because the BSE program is the only accredited biological engineering program in the State of Wisconsin, many students will transfer into the program after beginning their studies elsewhere.

Students transfer into the BSE program as pre-biological systems engineering students (i.e., as PAE classified students) or as ABE students. There are no minimum requirements to transfer in as a PAE student. To transfer in as an ABE student, you must meet all requirements for admission to the degree granting program. Effective spring term 2017, students with less than thirty (30) credits at the time of transfer must achieve ABE classification within three (3) regular semesters from the time of transfer. Transfer students with thirty (30) or more credits must achieve ABE classification within two (2) regular semesters of transferring into the program. Students who do not achieve ABE classification in a timely manner will not be allowed to continue in the BSE program.

Students at other UW institution or technical colleges planning to transfer to UW-Madison to obtain a BSE degree, should work with the UW-Madison BSE Department to ensure that the courses they are

taking will meet BSE degree requirements. If possible, such students should be enrolled in the Connections Program. The Connections Program offers select applicants, who are Wisconsin residents, the opportunity to start at a partner college or university and finish their bachelor's degree at UW-Madison—and hold a distinctive UW-Madison student status from the beginning. In other words, students are essentially simultaneously enrolled at both institutions. This means that students can lock into an official UW-Madison BSE curriculum at the time they start their studies at another institution.

The curriculum for the BSE major is updated on an annual or biennial basis. Students who plan on obtaining a BSE degree, but who begin working on BSE degree requirements prior to officially transferring into the program, should be aware of this since they will be required to meet the requirements of the curriculum in effect on the date of their official transfer into the program (i.e., they will not be allowed to use a curriculum previously in effect). Once enrolled in the program, they may (like all other enrolled students) elect to use a more current (i.e., updated) curriculum, but then must complete all requirements of the newer curriculum.

Admission to Degree-Granting Program

To be admitted to the "degree-granting" Biological Systems Engineering program with a designation/classification of ABE, a student must have the following:

1. A minimum of 24 degree credits.
2. A minimum of 17 credits of calculus, statistics, chemistry, computer science, statics and physics courses required for a BSE degree.
3. A BSE *Math and Science Grade Point Average* (MSGPA) of at least 2.80 with a minimum grade of C in every course used to calculate the MSGPA. See the following section for calculation of this average.
4. Successful completion of introductory chemistry (Chem 103/104 or 109 or equivalent) and math through Math 222.

As soon as you have simultaneously met all four of the preceding requirements, you are guaranteed ABE classification. However, this change does not become official until your academic advisor has filed an "Admission to Degree Classification" form with the CALS Office of Academic Affairs and they process the form. It is the student's responsibility to notify their advisor when they meet all requirements for degree-granting classification.

The preceding requirements for "degree granting" status differ from those for engineering departments in the College of Engineering in that BSE students are allowed to retake as many courses as needed to meet the requirements for ABE classification. Also, there is no time limit for students who join the department as freshmen as to when this requirement must be met. However, ABE classification is required for enrollment access to most upper-level BSE classes.

BSE Math and Science GPA Calculation

This *BSE Math and Science GPA* (MSGPA) is based on the following (and only the following) courses:

- All math courses 217 and above,
- Statistics courses 224 and above,
- All chemistry courses (i.e., all CHEM courses),
- All biology courses (i.e., all courses with a UW-Madison "Biological" breadth designation)
- Computer science courses 302 and above,
- EMA 201,
- Physics courses 201 and above.

Four very important conditions associated with the BSE Math and Science GPA calculation are:

1. You must have a grade of C or better in any course that has been completed and is included in the MSGPA calculation list.
2. For any course that a student repeats, only the most recent grade will be used in the calculation.
3. Any transfer course from another university that is included in the course list must be included in the GPA calculation.
4. There is no limit on the number of courses a student can retake or on the number of times a student can retake a specific course.

Condition 3 is a very important condition in that some students from outside the university are able to meet all conditions for ABE classification prior to transferring to UW-Madison. Condition 3 also allows students who are currently enrolled in the UW-Madison BSE program to take (or retake) math and science courses at other institutions while they are working toward their BSE degree.

To assist students in the BSE Math and Science GPA calculation, a spreadsheet has been developed and placed on the BSE website for download. See the "Student Resources" section under "Undergraduate Academics" on the BSE website for this spreadsheet.

Graduation Requirements

Students must maintain a 2.0 GPA or better to remain in the program, have at least a 2.0 GPA for the last semester in attendance and also for the combined last two semesters in attendance, and must have a 2.0 GPA or better for all courses designated as BSE.

Each student must complete the **Fundamentals of Engineering Examination** in order to get a grade in BSE 509. Students are not required to pass the exam. The Fundamentals of Engineering Exam is a national exam. It is to your advantage to take this exam as it is a precursor for the Professional Engineering (PE) Examination which can be taken after gaining the prerequisite amount of professional work experience. In some areas it is essential to have a PE license.

Students are asked to complete an Exit Survey just prior to graduation. Your survey responses are part of a continual program assessment process.

F. Official Curriculum

Following is the official BSE curriculum for the 2016-17 and 2017-18 school years. Students may use the official curriculum dated for the year they entered the program, or they may elect to use a more current curriculum, but then must complete all requirements of the newer curriculum. *The official curriculum is your contract with the major, and you must complete all listed requirements.* It is beneficial to track your progress using your official curriculum, the checklist for your option area, and an appropriate DARS report. There should be no discrepancy between these three. If there is, see your advisor immediately. *In all cases, the official curriculum takes precedence*.

2016-18 Curriculum Sheet - Biological Systems Engineering Degree

CALS Graduation Eligibility Requirements
_____120 credits Minimum number of degree credits necessary for graduation.
_____Minimum 2.0 Cumulative GPA
_____Last 30 Credits in Residence

UW Requirements
Courses may not double count within university requirements, but courses counted toward university requirements may also be used to satisfy a college requirement &/or a major requirement.
_____Communication Part A (2-3 cr.) Designated "a" in the Course Guide.
_____Communication Part B (2-3 cr.) Designated "b" in the Course Guide.
_____Quantitative Reasoning Part A (3 cr.) Designated "q" in the Course Guide.
_____Quantitative Reasoning Part B (3 cr.) Designated "r" in the Course Guide.
_____Ethnic Studies (3 cr.) Designated "e" in the Course Guide.
_____Humanities/Literature/Arts (6 cr.) Designated H, L, X, or Z in the Course Guide.
_____Social Sciences (3 cr.) Designated S, W, Y, or Z in the Course Guide.

CALS Requirements
Courses may not double count within college requirements, but courses counted toward college requirements may also be used to satisfy a university requirement &/or a major requirement.
_____First-Year Seminar (1 cr.) See DARS for full list.
Students who transfer into CALS after freshman year and continuing students who move to the B.S. degree should consult with Undergrad Programs & Services (116 Ag Hall) regarding completion of this requirement.
_____International Studies (3 cr.)
_____Physical Science Fundamentals (3 cr.) Must complete one General Chemistry course from the following list: CHEM 103, 108, 109. Consult major requirements prior to selecting.
_____Biological Science (5 cr.) Designated B or Y in the Course Guide.
_____Additional Science (3 cr.) Designated B, P, N, W, X, or Y in the Course Guide.
_____Science Breadth (3 cr.) Designated B, P, N, S, W, X, or Y in the Course Guide.

Possible Overlaps Between UW, CALS, & Major Requirements
Quantitative Reasoning Part A
Quantitative Reasoning Part B
Social Sciences
Physical Science Fundamentals
Biological Science
Additional Science
Science Breadth
120 Credits

BSE Major Requirements
Courses may not double count within the major (unless specifically noted otherwise), but courses counted toward the major requirements may also be used to satisfy a university requirement &/or a college requirement. A minimum of 15 credits must be completed in the major that are not used elsewhere. The BSE 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.
Mathematics and Statistics (19 cr.)
This major requires calculus. Prerequisites may need to be taken before enrollment in calculus. Refer to the Guide for information about calculus prereqs.
_____MATH 221 (r)
_____MATH 222 (r)
_____MATH 234 (r)
_____MATH 319 (r) or MATH 320 (r)
_____STAT 224 (r) or 324 (r)
Chemistry (5-9 cr.)
_____CHEM 109 (P) or CHEM 103 (P) and 104 (P)*
*Taking the combination of CHEM 103 and 104 (9 cr.) instead of CHEM 109 (5 cr.) may increase the total minimum number of credits required for graduation.
Biology (6-8 cr.)
_____BSE 349 (B)
_____BIOLOGY/BOTANY/ZOOLOGY 151 (B) or ZOOLOGY 153 (B) or BIOLOGY/BOTANY 130 (B) or BIOLOGY/ZOOLOGY 101 (B) or MICROBIO 101 (B) or 303 (B)* or biological science course**.
*MICROBIO 101 or 303 required for Food & Bioprocess Engineering specialization.
**Credits taken above 3 to meet this requirement may be counted under Category D of the technical elective section.
Physics (8 cr.)

_____E M A 201 (P)
_____PHYSICS 202 (P)

Foundation (9 cr.)

_____COMP SCI 310 [preferred] or CBE 255 or CIV ENGR/G L E 291
_____ACCT I S/I SYE 313 [preferred] or M E 314 or ACCT I S 300 (r) or ECON/FINANCE 300 (S) or GEN BUS 310 (S)
_____BSE 270

Core (7 cr.)

_____BSE 249 or CBE 250 (P)*
_____BSE 365
_____BSE 308

*Students selecting the Food & Bioprocess Engineering option who plan to enroll in CBE 310 and 320 must take CBE 250 here as a prerequisite. Students selecting the Food & Bioprocess Engineering option who plan to enroll in M E 361 and 363 are recommended to take BSE 249 here.

Specialization within Major:

General Program (18-25 cr.)

_____M E 361 (P) or CBE 310*
_____M E 363 or CIV ENGR 310 or B M E/CBE 320 (P)*
_____BSE 464
_____E M A 303 (P) or M E 306
_____Minimum of nine credits of 300 level or above non-BSE engineering courses
_____Minimum of three courses from: BSE 201, 367, 372, 441, 460, 461, 472, 473, 475, 476, 571, 642
* Take BSE 249 and M E 361 and M E 363, or take CBE 250 and CBE 310 and CBE 320.

Food & Bioprocess Engineering Specialization (Take all of the following courses and all of the courses for either the Food Engineering track or the Bioprocess Engineering track)

_____CHEM 341 (P)[preferred] or 343 (P)
_____M E 361 (P) or CBE 310*
_____M E 363 or B M E/CBE 320 (P)*
_____BSE 464

* Take BSE 249 and M E 361 and M E 364, or take CBE 250 and CBE 310 and CBE 320

Food Engineering Track **(33-35 credits when combined with above courses)**

_____FOOD SCI/MICROBIO 325 (B)
_____FOOD SCI 410 (B)
_____FOOD SCI 432
_____FOOD SCI 532
_____BSE 364
_____BSE 461
_____One BSE breadth course from the following list: BSE 367, 372, 460, 472, 473, 475, 476, 571

Bioprocess Engineering Track **(24-26 credits when combined with above courses.)**

_____MICROBIO 102 (B) or 304 (B)
_____BIOCHEM 501 (P)
_____BSE 364
_____BSE 367
_____BSE 460
_____BSE 461
_____One BSE breadth course from the following list: BSE 372, 441, 472, 473, 475, 476, 571

Natural Resources and Environment Specialization (22-25 cr.)

_____BSE/CIV ENGR/SOIL SCI 372
_____BSE 472
_____BSE 473
_____BSE 571
_____M E 361 (P)
_____CIV ENGR 310 or M E 363
_____BSE 201
_____E M A 303 (P) or M E 306
_____SOIL SCI 301 (P) or ENVIR ST/GEOG/SOIL SCI 230 (P)
_____One BSE breadth course from the following list: BSE 367, 441, 460, 461, 475, 476, 642

Machinery Systems Engineering Specialization (29-31 cr.)

_____BSE/M E 475
_____BSE/M E 476
_____E M A 202 (P) or M E 240
_____M E 306
_____E M A/M E 307
_____M E 313
_____M E 231

_____M E 340
_____M E 342 (P)
_____M E 361 (P)
_____M E 363
_____One BSE breadth course from the following list: BSE 356, 367, 372, 441, 460, 461, 472, 473, 571, 642

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**. See the BSE Undergraduate Student Handbook for a list of recommended technical electives for various areas of specialization.

A. Introduction to Engineering Course: INTEREGR 110 (1) or 170 (2). For freshman only.

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. Part 1. Upper-Level Engineering Courses: Engineering courses with a 300 or greater course number and E M A 202 or M E 240. This includes BSE courses not taken to meet other curricular requirements. This does not include independent study/instruction courses.

Part 2. Upper-Level Science Courses: Advanced biological, natural and physical science courses (i.e. courses with a B, N or P designation) and CHEM 341,342,343,344,345,421 and AGRONOMY/ASM OCN/SOIL SCI 532. This includes BSE courses not taken to meet other curricular requirements. This does not include independent study/instruction courses.

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 with a 100 or 200 level designation; 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 (5 cr.)
_____BSE 508
_____BSE 509
_____Fundamentals of Engineering Exam Required*
*Grades for BSE 509 will not be posted until proof of examination is presented.

G. Curriculum Checklist

The previous official curriculum can be a little confusing to follow, and it is not a document that lends itself to semester-by-semester program planning. For these reasons, the BSE Department has developed the curriculum checklist which appears on the following pages.

All UW-Madison undergraduate curricula can be broken into four sets of requirements based on who established and thus controls the requirements. For BSE, these four groups are:

1. University of Wisconsin-Madison requirements
2. College of Agricultural and Life Science (CALS) requirements
3. Biological Systems Engineering major requirements
4. Free electives

The UW-Madison and CALS requirements appear on the first page of the curriculum checklist, BSE core requirements (requirements that apply to all BSE students) appear on the second page of the checklist, the next five pages contain BSE specialty requirements, and the last page of the curriculum checklist is used to identify free electives. Specialty requirements are the 43 credits of courses required for each of the four specialization areas as well as the general program option. This 43 credit total includes a block of technical elective credits, the requirements of which are the same for all specialty areas.

Understanding this classification of requirements is important because multiple counting of courses between (but not within) these categories is allowed, and exceptions to requirements within a category can only be approved by representatives of the bodies that established the requirements. The latter means that the Biological Systems Engineering Department does not have the authority to approve course substitutions for University and CALS level requirements.

To simplify checklists, University and CALS requirements are not included on the checklists if the requirements are automatically met with BSE major requirements. Such is the case with the University's "Quantitative Reasoning Part A" and "Quantitative Reasoning Part B" requirements, and the CALS "physical and biological science fundamentals" requirements that appear in the official curriculum.

2016-18 CHECKLIST: Biological Systems Engineering

Student _____

Student ID _____

Telephone No. _____

Expected Graduation Month and Year _____

University General Education Requirements

Each course taken to meet a university general education requirement can be used to meet a CALS B.S. requirement and/or a requirement of the major.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			Communication Part A Course (2-3 credits) Any course with a *Comm-A* designation in the on-line Guide.	
			Communication Part B Course (2-3 credits) Any course with a *Comm-B* designation in the on-line Guide.	
			Ethnic Studies Course (minimum of 3 credits) Any course with an *Ethnic Studies* designation in the on-line Guide.	
			Humanities Courses (minimum of 6 credits). Courses with a *Humanities* or *Literature* breadth designation in the on-line Guide.	
			Social Science Course (minimum of 3 credits) Any course with a *Social Science* breadth designation in the on-line Guide.	

CALS Bachelor of Science Degree Requirements

Each course taken to meet a CALS B.S. requirement can be used to meet a university general education requirement and/or a requirement of the major.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			International Studies Course (minimum of 3 credits). For a list of eligible courses see the Guide.	
			First-Year Seminar Course (1 credit minimum). For a list of eligible courses see the Guide Waived for students who transfer into CALS after freshman year.	

BSE Major Requirements Common to All Option Areas

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			MATH 221 (5) Calculus and Analytic Geometry	
			MATH 222 (5) Calculus and Analytic Geometry	
			MATH 234 (3) Calculus - Functions of Several Variables	
			MATH 320 (3) [recommended] Linear Algebra and Differential Equations (*pre-req:* MATH 222) or MATH 319 (3) Techniques in Ordinary Differential Equations (*pre-req:* MATH 222)	
			STAT 224 (3) Intro Statistics for Engineers (*pre-reqs:* MATH 221) or STAT 324 (3) Introductory Applied Statistics for Engineers	
			CHEM 109 (5) Advanced General Chemistry or CHEM 103 (4) General Chemistry and CHEM 104 (5) General Chemistry	
			COMP SCI 310 (3) Problem Solving (preferred) or CBE 255 (3) or CIV ENGR 291 (3)	
			Biological Science Course: ZOOLOGY 151 (5), ZOOLOGY 153 (3), BOTANY 130 (5), ZOOLOGY 101 (3), MICROBIO 101 (3), MICROBIO 303 (3), or any other Biological breadth course. Credits taken above 3 may be counted as Category D Technical Electives, Food and Bioprocess Engineers need to take MICROBIO 101 or 303.	
			E M A 201 (3) Statics (*pre-req:* MATH 222)	
			PHYSICS 202 (5) General Physics (*pre-req:* MATH 211 or 221)	
			BSE 270 (3,F) Intro to Computer Aided Design	
			Engineering Econ Course: I SY E 313 (3) or M E 314 (3) or ACCT I S 300 (3) or FINANCE 300 (3) or GEN BUS 310 (3)	
			BSE 249 (3,F) Engr. Principles for Biological Systems (*pre-reg:* MATH 221), or CBE 250 (3) Process Synthesis (*pre-reqs:* Chem 329 or con reg). Note that CBE 250 is a prerequisite for CBE 310 and CBE 320 and must be taken by students who plan on enrolling in CBE 310 and CBE 320.	
			BSE 349 (3,S) Biological Concepts for Engineers (*pre-reqs*: MATH 222, CHEM 104 or 109, introductory biology course)	
			BSE 365 (3,S) Measurements and Instrumentation for Biological Systems (*pre-reqs:* STAT 224 & PHYSICS 202, ABE classification)	
			BSE 308 (1,S) Career Management for Engineers	
			BSE 508 (2,S) Biological Systems Engineering Design Practicum I (*pre-req:* ABE classification)	
			BSE 509 (3,F) Biological Systems Engineering Design Practicum II (*pre-reqs:* BSE 508, ABE classification)	

BSE Major Requirements for the General Program Option

Take BSE 249 and the M E 361, M E 363 and M E 364 sequence, or take CBE 250 and the CBE 310, CBE 320 and CBE 326 sequence.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234), or CBE 310 (3) Chemical Process Thermodynamics (*pre-reqs:* Math 234, Physics 201 or equiv; CBE 255 or equiv, CBE 250)	
			CIV ENGR 310 (3) Fluid Mechanics (*pre-reqs:* EMA 202, MATH 234), or M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361), or CBE 320 (4) Introductory Transport Phenomena (*pre-reqs:* Physics 201, Math 319 or 320, CBE 250)	
			E M A 303 (3) or M E 306 (3) Mechanics of Materials (*pre-reqs:* EMA 201, MATH 222)	
			BSE 464 (3,S) Heat and Mass Transfer in Biological Systems (*pre-reqs:* M E 361, CBE 310 or an equivalent Thermodynamics course; M E 363, CBE 320, CEE 310 or an equivalent Fluid Mechanics course)	
			Minimum of three courses from: BSE 201 (1,F), 364 (3,S), 367 (3,S+F), 372 (2,F), 460 (3,F), 461 (3,S), 472 (3,S), 473 (2,F), 475 (3,F), 476 (3,S), 571 (3,S), and 642 (2,S)	
			Minimum of nine credits of 300 level or above non-BSE engineering courses.	
			Category A Technical Electives. Introduction to Engineering Course: INTEREGR 110 (1), INTEREGR 170 (2)	
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
			Category C Technical Electives. Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all **advanced** level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	
			Category D Technical Electives. Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category.	
	TOTAL credits in general option area must be no less than **43**			

BSE Major Requirements for F & BE Specialization - Bioprocess Engineering Track

Take BSE 249 and the M E 361, M E 363 and M E 364 sequence, or take CBE 250 and the CBE 310, CBE 320 and CBE 326 sequence.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			CHEM 343 (3) [preferred] or CHEM 341 (3) Introductory Organic Chemistry (*pre-reqs:* CHEM 104 or 109)	
			M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234), or CBE 310 (3) Chemical Process Thermodynamics (*pre-reqs:* MATH 234, PHYSICS 201 or equiv; CBE 255 or equiv, CBE 250)	
			M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361), or CBE 320 (4) Introductory Transport Phenomena (*pre-reqs:* Physics 201, Math 319 or 320, CBE 250)	
			MICROBIO 102 (2) General Microbiology Laboratory (*pre-reqs:* MICROBIO 101 or con), or MICROBIO 304 (2**)** Biology of Microorganisms Lab (*pre-reqs:* MICROBIO 303 or con reg)	
			BIOCHEM 501 (3) Introduction to Biochemistry (*pre-reqs:* CHEM 341 or 343)	
			BSE 364 (3,S) Engineering Properties of Food and Biological Materials (*pre-reqs:* Stat 224 & Physics 202)	
			BSE 367 (3,S+F) Renewable Energy Systems	
			BSE 460 (3,F) Biorefining: Energy and Products from Renewable Resources (*pre-reqs:* CHEM 109 or 104; organic chem or equiv)	
			BSE 461 (3,F) Food & Bioprocessing Operations (*pre-reqs:* (BSE 249 or CBE 250) and (CIV ENGR 310 or CBE 320 or M E 363), ABE classification)	
			BSE 464 (3,S) Heat and Mass Transfer in Biological Systems (*pre-reqs:* M E 361, CBE 310 or an equivalent thermo course; M E 363, CBE 320, CEE 310 or an equivalent fluids course)	
			BSE Breadth Course. One course from the following: 372 (2,F), 472 (3,S), 473 (2,F), 475 (3,F), 476 (3,S), 571 (3,S)	
			Category A Technical Electives. Introduction to Engineering Course: INTEREGR 110 (1), INTEREGR 170 (2)	
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
			Category C Technical Electives. Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all advanced level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	
			Category D Technical Electives. Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category**.**	
	TOTAL credits in bioprocess engineering specialization area must be no less than **43**			

BSE Major Requirements for F & BE Specialization - Food Engineering Track

Take BSE 249 and the M E 361, M E 363 and M E 364 sequence, or take CBE 250 and the CBE 310, CBE 320 and CBE 326 sequence.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			CHEM 343 (3) [preferred] or CHEM 341 (3) Introductory Organic Chemistry (*pre-reqs:* CHEM 104 or 109)	
			M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234), or CBE 310 (3) Chemical Process Thermodynamics (*pre-reqs:* MATH 234, CBE 255 or equiv, CBE 250)	
			M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361), or CBE 320 (4) Introductory Transport Phenomena (*pre-reqs:* Physics 201, Math 319 or 320, CBE 250)	
			BSE 464 (3) Heat and Mass Transfer in Biological Systems (*pre-reqs:* M E 361, CBE 310 or an equivalent thermo course; M E 363, CBE 320, CEE 310 or an equivalent fluids course)	
			MICROBIO/FOOD SCI 325 (3) Food Microbiology (*pre-reqs:* MICROBIO 101 or 303)	
			FOOD SCI 410 (3) Food Chemistry (*pre-req:* CHEM 343)	
			FOOD SCI 432 (3) Principles of Food Preservation (*pre-reqs:* FOOD SCI 325, 410, 440, or cons inst)	
			FOOD SCI 532 (4) Integrated Food Manuf. (*pre-reqs:* FOOD SCI 321, 432, or cons inst)	
			BSE 364 (3,S) Engineering Properties of Food and Biological Materials (*pre-reqs:* Stat 224 & Physics 202)	
			BSE 461 (3,F) Food & Bioprocessing Operations (*pre-reqs:* (BSE 249 or CBE 250) and (CIV ENGR 310 or CBE 320 or M E 363), ABE classification)	
			BSE Breadth Course. One course from the following: 372 (2,F), 472 (3,S), 473 (2,F), 475 (3,F), 476 (3,S), 571 (3,S)	
			Category A Technical Electives. Introduction to Engineering Course: INTEREGR 110 (1), INTEREGR 170 (2)	
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
			Category C Technical Electives. Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all advanced level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	
			Category D Technical Electives. Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category**.**	
	TOTAL credits in food engineering specialization area must be no less than **43**			

BSE Major Requirements for the Machinery Systems Engineering Specialization

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			BSE 475 (3,F) Engineering Principles-of Ag Machinery (*pre-reqs:* E M A 202 or M E 240, ABE classification)	
			BSE 476 (3,S) Engr. Principles of Off-Road Vehicles (*pre-reqs:* ME 361, E M A 202 or M E 240, ABE classification)	
			E M A 202 or M E 240 (3) Dynamics (*pre-reqs:* E M A 201, MATH 222)	
			M E 306 (3) Mechanics of Materials (*pre-reqs:* E M A 201, MATH 222)	
			M E 307 (1) Mechanics of Materials Lab (*pre-reqs:* M E 306 or con reg)	
			M E 313 (3) Manufacturing Processes	
			M E 231 (2) Introductory Engineering Graphics	
			M E 340 (3) Introduction to Dynamic Systems (*pre-reqs:* E M A 202, COMP SCI 310)	
			M E 342 (3) Design of Machine Elements (*pre-reqs:* M E 306, 307 & M E 331, 340) (ME 331 not required for BSE students)	
			M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234)	
			M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361)	
			BSE Breadth Course. One course from the following: 367 (3,S+F), 372 (2,F), 460 (3,F), 461 (3,S), 472 (3,S), 473 (2,F), 571 (3,S), 642 (2,S)	
			Category A Technical Electives. Introduction to Engineering Course: INTEREGR 110 (1), INTEREGR 170 (2)	
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
			Category C Technical Electives. Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all advanced level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	
			Category D Technical Electives. Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category**.**	
	TOTAL credits in machinery systems engineering specialization area must be no less than **43**			

BSE Major Requirements for the Natural Resources & Environment Engr. Specialization

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
			BSE 201 (1,F) Land Surveying Fundamentals	
			BSE 372 (2,F) On-Site Waste Water Treatment	
			BSE 472 (3,S) Sediment & Bio-Nutrient Engineering & Management	
			BSE 473 (2,F) Irrigation and Drainage System Design	
			BSE 571 (3,S) Small Watershed Engineering	
			SOIL SCI 230 (3) Soil: Ecosystem and Resource, or SOIL SCI 301 (4) General Soil Science (*pre-reqs:* CHEM 103)	
			E M A 303 (3) or M E 306 (3) Mechanics of Materials (*pre-reqs:* E M A 201, MATH 222)	
			CIV ENGR 310 (3) Fluid Mechanics (*pre-reqs:* E M A 202, MATH 234), or M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361)	
			M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234)	
			BSE Breadth Course. One course from the following: 367 (3,S+F), 460 (3,F), 461 (3,S), 475 (3,F), 476 (3,S), or 642 (2,S)	
			Category A Technical Electives. Introduction to Engineering Course: INTEREGR 110 (1), INTEREGR 170 (2)	
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
			Category C Technical Electives. Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all advanced level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	
			Category D Technical Electives. Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category**.**	

TOTAL credits in natural resources & environment engineering specialization area must be no less than **43**

Free Electives

Crds	Sem/Yr Taken	Grade	Course

_____ TOTAL for Degree – Minimum 125 Credits Required (no course can be counted twice)

To be admitted to the degree-granting designation of ABE (biological systems engineering), a student must have:

1. A minimum of 24 degree credits.
2. A minimum of 17 credits of calculus, statistics, chemistry, biology, computer science, statics and physics courses required for a BSE degree.
3. A BSE *Math and Science Grade Point Average* (MSGPA) of at least 2.80 with a minimum grade of C in every course used to calculate the MSGPA. The MSGPA is based on the following (and only the following) courses: all math courses 217 and above; statistics courses 224 and above; all chemistry courses (i.e., all CHEM courses); all biology courses (i.e., all courses with a UW-Madison "Biological" breadth designation); computer science courses 302 and above; EMA 201; and Physics courses 201 and above. For any course that a student repeats, only the most recent grade will be used in the calculation. Any transfer course from another university that is included in the previous list must be included in the GPA calculation. There is no limit on the number of courses a student can retake or on the number of times a student can retake a specific course.
4. Successful completion of introductory chemistry (Chem 103/104 or 109 or equivalent) and math through Math 222.

Maintaining an Up-To-Date Curriculum Checklist

Each semester, prior to registration for the following semester, all BSE students must meet with their academic advisor. Prior to this meeting, each student must email an up-to-date "curriculum checklist" to their advisor.

The curriculum checklist sent to the advisor must not only identify all completed courses, but must also include all courses in which the student is currently enrolled, and all courses in which the student plans on enrolling in the following semester (students will often enter the latter in a different color text or will use a different color background for the text). The ideal checklist identifies when a student plans on taking all remaining required courses. As the example on the following pages illustrates, this is most effectively done by using a different color background to identify courses that will be taken during different semesters.

Checklists can be downloaded from the BSE website (http://bse.wisc.edu/). When filling in your curriculum checklist, use the comment section to list the number of the course being used to meet the requirement if it is not abundantly clear (note that in some cases one or more course options exist and you will use the comment section to identify which course you specifically took to meet the requirement). If the course is a transfer course, also identify the school from which the course was transferred and the course number at that institution (e.g., Chem 104 taken at Madison College as NATSCI 209 College Chemistry 2). For requirements met via advanced placement (AP) note in the comment section that the requirement was met via advanced placement (e.g. Math 221 via AP exam). When entering grades, include grades for transfer courses (i.e., the grades received at the other institutions) and enter the numeric scores received on advanced placement (AP) exams. If a course has been taken more than once, only enter the grade from the last time the course was taken.

Compare your completed checklist with your DARS report. If DARS is not properly categorizing one or more courses, you may have to complete a *Request for DARS Exception* form. The form must be signed by your advisor and the chair of the BSE Undergraduate Instruction and Program Committee (currently Professor Anex).

Save your completed checklist as a MSWord document with a title "BSE_Checklist_YourLastName_YourFirstName_Currentdate" (e.g. BSE_Checklist_Einstein_Albert_01-01-11). The date is important as you will be updating and sending your advisor an updated checklist prior to meeting with him/her each semester.

Requiring that an up-to-date curriculum checklist be submitted prior to the advisor meeting (and thus prior to removal of the registration hold) forces students to think about their future plan of study and helps ensure that they are familiar with all program requirements. A well thought out curriculum is essential for students who plan on being away from the university as part of a cooperative work experience or study abroad program. It becomes increasingly important the closer a student gets to graduation.

Sample Up-To-Date Curriculum Checklist

2016-18 CHECKLIST: Biological Systems Engineering

Food & Bioprocess Engineering Specialization

Food Engineering Track [Example as it would appear during Fall 17]

Student Albert Einstein

Student ID 012-345-6789

Telephone No. 888-555-1212

Expected Graduation Month and Year May 2019

University General Education Requirements

Each course taken to meet a university general education requirement can be used to meet a CALS B.S. requirement and/or a requirement of the major.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
2	Fall 15	A	Communication Part A Course (2-3 credits) Any course with a *Comm-A* designation in the on-line Course Guide.	EPD 155
3	Fall 17	IP	Communication Part B Course (2-3 credits) Any course with a *Comm-B* designation in the on-line Course Guide.	EPD 397
3	Fall 18		Ethnic Studies Course (minimum of 3 credits) Any course with an *Ethnic Studies* designation in the on-line Course Guide.	History 279
3	Spring 18		Humanities Courses (minimum of 6 credits). Courses with a *Humanities* or *Literature* breadth designation in the on-line Course Guide.	
3	Fall 18			
3	Spring 19		Social Science Course (minimum of 3 credits) Any course with a *Social Science* breadth designation in the on-line Course Guide.	

CALS Bachelor of Science Requirements

Each course taken to meet a CALS B.S. requirement can be used to meet a university general education requirement and/or a requirement of the major.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
3	Fall 18		International Studies Course (minimum of 3 credits). For a list of eligible courses see the Guide.	History 279
2	Fall 15	A	First-Year Seminar Course (1 credit minimum). For a list of eligible courses see the Guide. Waived for Students who transfer into CALS after freshman year.	INTEREGR 170

BSE Major Requirements Common to All Option Areas

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
5	-----	5	MATH 221 (5) Calculus and Analytic Geometry	Math 221 Via AP Exam
5	Summer 16	A	MATH 222 (5) Calculus and Analytic Geometry	Taken as 232 Calc 2 at MATC
3	Fall 16	A	MATH 234 (3) Calculus - Functions of Several Variables	
3	Fall 17	IP	MATH 320 (3) [recommended] Linear Algebra and Differential Equations (*pre-req:* MATH 222) or MATH 319 (3) Techniques in Ordinary Differential Equations (*pre-req:* MATH 222)	
3	Spring 17	A	STAT 224 (3) Intro Statistics for Engineers (*pre-reqs:* MATH 221) or STAT 324 (3) Introductory Applied Statistics for Engineers	STAT 224
5	Fall 15	A	CHEM 109 (5) Advanced General Chemistry or CHEM 103 (4) General Chemistry and CHEM 104 (5) General Chemistry	CHEM 103
4	Spring 16	A		CHEM 104
3	Spring 17	A	COMP SCI 310 (3) Problem Solving (preferred) or CBE 255 (3) or CIV ENGR 291 (3)	Substituted COMP SCI 302
3	Spring 16	A	MICROBIO 101 or 303	MICROBIO 101
3	Spring 17	A	E M A 201 (3) Statics (*pre-req:* MATH 222)	
5	Spring 16	A	PHYSICS 202 (5) General Physics (*pre-req:* MATH 211 or 221)	
2	Spring 16	A	BSE 270 (3,F) Intro to Computer Aided Design	
3	Fall 17	IP	Engineering Econ Course: I SY E 313 (3) or M E 314 (3) or ACCT I S 300 (3) or FINANCE 300 (3) or GEN BUS 310 (3)	I SY E 313
3	Fall 16	A	BSE 249 (3,F) Engr. Principles for Biological Systems (*pre-reg:* MATH 221), or CBE 250 (3) Process Synthesis (*pre-reqs:* Chem 329 or con reg). Note that CBE 250 is a prerequisite for CBE 310 and CBE 320 and must be taken by students who plan on enrolling in CBE 310 and CBE 320.	BSE 249
3	Spring 17	A	BSE 349 (3,S) Biological Concepts for Engineers (*pre-reqs*: MATH 222, CHEM 104 or 109, introductory biology course)	
3	Spring 18		BSE 365 (3,S) Measurements and Instrumentation for Biological Systems (*pre-reqs:* STAT 224 & PHYSICS 202, ABE classification)	
1	Spring 18		BSE 308 (1,S) Career Management for Engineers	
2	Spring 18		BSE 508 (2,S) Biological Systems Engineering Design Practicum I (*pre-req:* ABE classification)	
3	Fall 18		BSE 509 (3,F) Biological Systems Engineering Design Practicum II (*pre-reqs:* BSE 508, ABE classification)	

2016-18 Course Requirements for BSE Degree

BSE Major Requirements for F & BE Specialization - Food Engineering Track

Take BSE 249 and the M E 361, M E 363 and M E 364 sequence, or take CBE 250 and the CBE 310, CBE 320 and CBE 326 sequence.

Crds	Sem/Yr Taken	Grd	Requirement	Course Taken to Meet Requirement
3	Fall 16	A	CHEM 343 (3) [preferred] or CHEM 341 (3) Introductory Organic Chemistry (*pre-reqs:* CHEM 104 or 109)	CHEM 341
3	Spring 17		M E 361 (3) Thermodynamics (*pre-reqs:* E M A 202, MATH 234), or CBE 310 (3) Chemical Process Thermodynamics (*pre-reqs:* MATH 234, CBE 255 or equiv, CBE 250)	ME 361
3	Spring 18		M E 363 (3) Fluid Dynamics (*pre-reqs:* M E 361), or CBE 320 (4) Introductory Transport Phenomena (*pre-reqs:* Physics 201, Math 319 or 320, CBE 250)	ME 363
3	Fall 18		BSE 464 (3,S) Heat and Mass Transfer in Biological Systems (*pre-reqs:* M E 361, CBE 310 or an equivalent thermo course; M E 363, CBE 320, CEE 310 or an equivalent fluids course)	ME 364
3	Fall 16	A	MICROBIO/FOOD SCI 325 (3) Food Microbiology (*pre-reqs:* MICROBIO 101 or 303)	
3	Fall 16	A	FOOD SCI 410 (3) Food Chemistry (*pre-req:* CHEM 343)	
3	Spring 17	A	FOOD SCI 432 (3) Principles of Food Preservation (*pre-reqs:* FOOD SCI 325, 410, 440, or cons inst)	
4	Fall 17	IP	FOOD SCI 532 (4) Integrated Food Manuf. (*pre-reqs:* FOOD SCI 321, 432, or cons inst)	
3	Spring 18		BSE 364 (3,S) Engineering Properties of Food and Biological Materials (*pre-reqs:* Stat 224 & Physics 202)	
3	Spring 19		BSE 461 (3,S) Food & Bioprocessing Operations (*pre-reqs:* (BSE 249 or CBE 250) and (CIV ENGR 310 or CBE 320 or M E 363), ABE classification)	BSE 461
3	Fall 17	IP	BSE Breadth Course. One course from the following: 356 (3,S), 372 (2,F), 441 (3,S), 472 (3,S), 473 (2,F), 475 (3,F), 476 (3,S), 571 (3,S)	BSE 475
2	Fall 15	A	**Category A Technical Electives. Introduction to Engineering Course:** INTEREGR 110 (1), INTEREGR 170 (2)	INTEREGR 170
			Category B Technical Electives. Independent Study/Instruction Courses: CALS or CoE courses with a 001, 299, 399, or 699 course number. No more than 3 credits of coursework allowed in this category.	
3	Fall 17	IP	**Category C Technical Electives.** Upper-Level Engineering and Science Courses: Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all advanced level courses with a biological, natural and/or physical science breadth designation plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.	E P D 397
2	Fall 15	A	**Category D Technical Electives.** Lower-Level Science and Engineering Courses, Breadth Courses: Elementary and intermediate biological, natural and physical science courses except elementary and intermediate math courses; CoE courses with a 100 or 200 level designation; CALS courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework allowed in this category.	EPD 155
5	Fall 15	A		PHYSICS 201
2	Spring 19			Fermentation Course
48	TOTAL credits in food engineering specialization area must be no less than **43**			

Free Electives

Crds	Sem/Yr Taken	Grade	Course

_____ TOTAL for Degree – Minimum 125 Credits Required (no course can be counted twice)

To be admitted to the degree-granting designation of ABE (biological systems engineering), a student must have:

5. A minimum of 24 degree credits.
6. A minimum of 17 credits of calculus, statistics, chemistry, biology, computer science, statics and physics courses required for a BSE degree.
7. A BSE *Math and Science Grade Point Average* (MSGPA) of at least 2.80 with a minimum grade of C in every course used to calculate the MSGPA. The MSGPA is based on the following (and only the following) courses: all math courses 217 and above; statistics courses 224 and above; all chemistry courses (i.e., all CHEM courses); all biology courses (i.e., all courses with a UW-Madison "Biology" breadth designation); computer science courses 302 and above; EMA 201; and Physics courses 201 and above. For any course that a student repeats, only the most recent grade will be used in the calculation. Any transfer course from another university that is included in the previous list must be included in the GPA calculation. There is no limit on the number of courses a student can retake or on the number of times a student can retake a specific course.
8. Successful completion of introductory chemistry (Chem 103/104 or 109 or equivalent) and math through Math 222.

Testing out the ASABE ¼-scale pulling tractor at the West Madison Agricultural Research Station

H. Multiple Counting of Courses

Multiple counting occurs when a student uses the same course to meet a requirement in more than one of the three major categories: University requirements, CALS requirements, and BSE major requirements. The same course can be counting once in each of these three main categories, but never more than once in the same category. This means, for example, that you can not use the same course to meet two different University requirements.

Multiple counting enables more students to graduate without exceeding the minimum of 125 credits required for a BSE degree. By multiple counting courses, students increase the number of free elective courses they can take without exceeding the 125 credit minimum. As a result, "non-required" courses taken prior to entering the BSE program are less likely to be "wasted" (i.e., there is a greater likelihood they can be used to help meet the 125 credit minimum), and/or students are better able to complete the requirements of a special certificate program without exceeding the 125 credit minimum.

It is important to understand that double counting a course does not double the credit value of the course. For example, if a 3 credit course is used to meet the University Comm B requirement and is also counted as a Category D Technical Elective, it still only counts as 3 credits toward the 125 minimum.

To make use of multiple counting, a student should clearly understand the specific University requirements, CALS requirements, and BSE major requirements. Perhaps most important is to be familiar with the following BSE technical elective requirements, as students can potentially double count all University and CALS requirements as BSE technical electives. That said, attempting to do this will generally produce more technical elective credits than is needed to meet the 43 credit total required for the area of specialization.

BSE Technical Electives

- **Category A Technical Electives. Introduction to Engineering Course:** INTEREGR 110 (1), INTEREGR 170 (2). Courses that are no longer taught, but will count in this category include INTEREGR 102, 111, and 160.
- **Category B Technical Electives. 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.
- **Category C Technical Electives. Upper-Level Engineering and Science Courses:** Upper-level engineering courses includes engineering courses with a 300 or greater course number, any BSE courses not taken to meet other curricular requirements, and E M A 202 (or M E 240) when not taken to meet another curricular requirement. Upper-level science courses includes all **advanced** biological, natural and physical science courses (i.e., courses with a B, N or P breadth designation and an advanced level designation) plus CHEM 341, 342, 343, 344, 345, 421 and AGRONOMY/ASM OCN/SOIL SCI 532. Independent study/instruction courses (BSE or otherwise) can not be included in this category.
- **Category D Technical Electives. 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 with a 100 or 200 level designation; College of Agricultural and Life Science courses, Institute of Environmental Studies courses, and/or School of Business courses. Independent study/instruction courses can not be counted in this category. No more than 12 credits of coursework in this category can be used to meet technical elective requirements.

University Requirements

The University requirements include:

1. Communications Part A (2-3 credits). Includes: COM ARTS 100; ENGLISH 100, X04; ESL 118; EPD 155; L SC COM 100; AP English; or any other course designated “a” in the Guide. The preceding courses are not available to students who test out of Comm-A on UW-Placement exam or have Comm-A credit for AP English. Students who do not test out of Comm-A may receive credit for one, but only one, Comm-A course, including AP English. A student is exempt from the Comm-A requirement by the UW-Placement Exam if they receive a score of 4 or 5 on both the Composition and Language Exam and the Literature and Composition Exam. Note that EPD 155 and L SC COM 100 can be double counted as Category D Technical Electives.
2. Communications Part B (2-3 credits). Includes any course designated “b” in the Guide. Highly recommended is EPD 397 which can be double counted as a Category C Technical Elective. Also double counting as Comm B and a Category C Technical Elective are CHEM 346, CBE 424 and MICROBIO 551. Comm B courses that can be double counted as Category D Technical Electives include: BOTANY 330; ZOOLOGY 220; BIOCORE 302, 304; PSYCH 225, 285; ATM OCN/ENVIR ST 171; ASTRON 236; L SC COM 111, 212, 360, 430, 560; BIOLOGY/BOTANY/ZOOLOGY 152; LAND ARC 551, FOOD SCI 603; C&E SOC 210.
3. Ethnic studies (3 credits). Includes any course designated “Ethnic Studies” in the Guide.
4. Social science (3 credits). Any course with a breadth designation of "Social Science" in the Guide.
5. Humanities (6 credits). Any course with a breadth designation of "Humanities" and “Literature” in the Guide.

CALS Requirements

Although there are several CALS requirements, most are automatically met when BSE major requirements are completed. To this end, there is a measureable amount of double counting that automatically occurs. CALS requirements that are not automatically met by the BSE major requirements are (1) a minimum 1-credit first-year seminar course, and (2) a minimum 3-credit CALS International Studies course.

The first-year seminar course is only required of students who are enrolled in the BSE degree program during their freshman year (students entering CALS after their freshman year are exempted from this requirement). First-year seminar course INTEREGR 170 can also be counted as Category A Technical Electives. First-year seminar courses BIOLOGY 100 (Exploring Biology), Environmental Studies 402 (GreenHouse Roots Seminar), F&W ECOL 101 (Orientation to Wildlife Ecology), GENETICS 155 (Genetics Freshman Seminar), INTER-AG 155 (CALS Freshman Seminar), INTER-AG 165 (International Issues in Agriculture, Environment and Life Sciences), and INTER-AG 175 (Women in Science and Engineering Seminar) can be counted as Category D Technical Electives.

The course taken to meet the International Studies requirement is frequently used by a student to meet another degree requirement. In several cases, the course can be triple counted (i.e., used to meet a University and a BSE major requirement in addition to the CALS International Studies requirement). To choose a course, see the list of courses in the Guide.

I. Professional Work Experience

It is extremely important for students to obtain as much practical professional experience as possible before graduation. In addition to the knowledge and skills to be gained from such experiences, it demonstrates to potential employers one's enthusiasm for their selected profession.

Obtaining Credit for Work Experience

Although there is no requirement that students obtain professional work experience prior to graduation, each student can receive up to a maximum of 3 credits of technical elective credit for such experience. It is important to note that to receive technical elective credit for a particular work experience a student must register for either BSE 001, BSE 299, BSE 399 or BSE 699 and pay the associated fees. Under which of these four courses a student registers, and the number of credits for which a student registers, depends upon the type of work experience.

BSE 001: *Cooperative Education Program*

A student who will be employed **full**-time (considered to be approximately 40 hours per week for 15 weeks) **off**-campus can enroll in BSE 001. Registration is for a single credit for each spring, summer or fall in which the student is employed. By registering for 1 credit of BSE 001 during the fall and/or spring semester, the student retains their status as a full-time UW-Madison student (note that any student who is registered as a fulltime student during the spring semester and has not graduated, retains their fulltime status during the following summer even if they are not registered for a course). Maintaining status as a fulltime student is often a requirement for continual deferral of student loans.

A student who registers for BSE 001 must complete the BSE Internship/Cooperative Education Agreement Form prior to beginning their co-op. This form is available on the BSE website and must be signed by the student, their academic advisor and the supervisor to whom they will be reporting during their employment. In accordance with this signed agreement, the student must submit (to their academic advisor) monthly progress reports and a final written report (the latter must be no less than 1000 words in length).

Students who are on a co-op are not eligible for student loans or grants while on the co-op, and some scholarships may be deferred until the student returns to campus.

If their work schedule permits it, a students employed full-time off-campus may opt to take one or more on-line courses while on their co-op. To do this, a student simply enrolls in the courses along with their registration in 001. The fee schedule is no different than it would be for students taking courses on campus.

One advantage of living in University-owned housing is that University Housing will allow a student to be released from their contract to leave campus for a co-op. No payment is required, however the student must forfeit their deposit. Contact the Division of University Housing for more information (608-262-2522).

BSE 399: *Coordinative Internship*

A student working part-time while attending UW-Madison may elect to enroll in BSE 399. The BSE Department policy is that a student may register for 1 credit of BSE 399 for each 150 hours of work. Although a student can register for more than one credit of BSE 399 during a particular spring, summer or fall, nor more than two credits per semester can be used to meet technical elective requirements.

A student who registers for BSE 399 will not automatically be granted fulltime status as a UW-Madison student unless they are registered for 12 or more credits. When a student is registered for less than 12 credits, and the combination of course work and professional work experience are deemed equivalent to full-time professional employment, the student is encouraged to apply for an academic load exception that

grants fulltime student status. Such an application must be obtained from an academic dean in the CALS Undergraduate Program and Services Office, 116 Ag Hall.

A student who registers for BSE 399 must also complete the BSE Internship/Cooperative Education Agreement Form prior to beginning their internship. This form is available on the BSE website and must be signed by the student, their academic advisor and the supervisor to whom they will be reporting during their employment. In accordance with this signed agreement, the student must submit (to their academic advisor) monthly progress reports and a final written report. The final report shall be a minimum of 1000 words for each academic credit in which the student is enrolled.

BSE 299: *Independent Study*

BSE 299 is for any **freshman, sophomore** or **junior** who is engaged in one-on-one instructional sessions during which they work with and/or under the guidance of a faculty member on a specific project. Quite frequently, the project is associated with the faculty member's research, and the student is an employee of the faculty member.

The policy of the BSE Department is that a student work a minimum of 45 hours for each credit of BSE 299 for which they enroll. Each student who enrolls in BSE 299 must submit a final report with a minimum length of 1500 words. Additionally, each student must make a formal oral presentation of their work. This could be a "brown bag" presentation to faculty, staff and students, a presentation at an ASABE student branch meeting, a presentation to a class of students enrolled in another course, or a presentation at a professional society meeting.

BSE 699: *Special Problems*

BSE 699 is for any **senior** who is engaged in one-on-one instructional sessions during which they work with and/or under the guidance of a faculty member on a specific project. Quite frequently, the project is associated with the faculty member's research, and the student is an employee of the faculty member.

The policy of the BSE Department is that a student work a minimum of 45 hours for each credit of BSE 699 for which they enroll. Each student who enrolls in BSE 699 must submit a final report with a minimum length of 1500 words. Additionally, each student must make a formal oral presentation of their work. This could be a "brown bag" presentation to faculty, staff and students, a presentation at an ASABE student branch meeting, a presentation to a class of students enrolled in another course, or a presentation at a professional society meeting.

Finding Employment

There are numerous sources available to students seeking co-ops and internships. The two primary sources for BSE students are the Engineering Career Service Office, Suite 170, 1410 Engineering Drive (608-262-3471), and the CALS Career Services Office, 116 Agriculture Hall, 1450 Linden Drive (608-262-3003). Employers looking for BSE students will generally contact one or both of these offices directly, or will be told by BSE staff to contact these offices.

BuckyNet is an online system to connect students/alumni and employers. Students find internships, co-ops and full-time employment opportunities, sign-up for on-campus interviews, research employers, and find out about career events. CALS students are given a BuckyNet account soon after declaring a CALS major. If you have any questions about accessing your account, e-mail CALS Career Services at career@cals.wisc.edu. All CALS undergraduate students, graduate students, and alumni have access to BuckyNet.

In addition to on-campus resources, students are encouraged to visit employer websites and on-line sources that specialize in job placement, contact their local chamber of commerce, browse newspapers and journals, attend local career fairs, and network with family, friends, relatives, fellow students, alumni and professional associates.

If you are interested in international work, note that many companies who recruit UW-Madison engineering students are multi-national. Another option is to contact IAESTE (International Association for the Exchange of Students for Technical Experience). IAESTE helps students locate jobs in more than 70 countries and will help a student with the required work authorization paperwork. IAESTE's annual registration deadline is January 1. Their website address is iaeste.org.

Benefits of Co-ops / Internships

Obtaining work experience prior to completing your degree requirements typically increases employment opportunities and starting salaries at graduation.

Companies use co-op/internships as a means to screen potential employees. This is not surprising, given the desire that companies have to reduce the risk associated with hiring individuals for full-time employment who they have not been able to observe in a work environment. Through various work activities/assignments, an employer can assess critical personal characteristics/traits such as punctuality, enthusiasm, honesty, integrity, temperament, etc., in addition to teamwork and communication skills, basic knowledge, analytical skills and creativity. Upon completion of their co-op/internship, many students receive offers for full-time employment from the company for which they worked.

J. Semester-by-Semester Course Planning

This section contains four-year road maps for each program specialization and the general program option. Each four-year road map provides a semester-by-semester list of courses to be completed. The exact order in which you take courses is unlikely to match the four-year road map since the order in which you take courses will be influenced by success on advanced placement exams, choice of technical electives and occasional scheduling conflicts. When you are unsure of which courses to take during a particular semester and/or run into a scheduling conflict, it is always best to consult your academic advisor. In such situations, three good rules of thumb are to: (1) take first those courses that are prerequisites for other required courses (2) take required courses before electives, and (3) save your social science, humanities, ethnics studies, economics and international studies courses for your junior and senior years and/or a study abroad experience.

Students who plan to study abroad should avoid taking courses at UW-Madison that could be taken while studying abroad. This includes basic math, statistics, and science courses as well as social sciences and humanities. In many cases, the university attended abroad will have courses related to the major that, with special action, can be counted for technical elective credit.

Frequency of BSE Course Offerings

When developing your semester-by-semester course plan, it's important to realize that many courses are only offered once a year. This is currently true of all BSE lecture courses except BSE 367 as the following lists reveal.

BSE courses taught during the fall semester: 201, 249, 270, 367, 372, 460, 461, 473*, 475, 509, and 671.

BSE courses taught during the spring semester: 308, 349, 364, 365, 367, 441, 464, 472, 476, 508 and 571.

* Taught every other year in the fall- odd years only (2015, 2017, etc.).

Prerequisite of ABE Classification

BSE 365, 461, 475, 476, 508 and 509, some Food Science courses and many upper level College of Engineering courses require that a student be classified ABE. This is done to insure that the student has the basic math and science knowledge required to successfully complete the course(s). For this reason, one of the primary goals of a student with a PAE classification should be to achieve ABE classification in a timely manner.

Four Year Road Map
General Program Option

Yr	Sem.	Course	X	Crds	Sem. Total
1	Fall	MATH 221 *Calculus and Analytic Geometry*		5	16
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		CHEM 109 *Advanced General Chemistry**		5	
		Biological Science Course		3	
1	Spring	MATH 222 *Calculus and Analytic Geometry*		4	14
		INTEREGR 170 *Design Practicum*		2	
		COMP SCI 310 *Problem Solving Using Computers*		3	
		E P D 155 *Basic Communication* or other Comm A course		2	
		ISyE 313 *Engineering Economic Analysis*		3	
2	Fall	MATH 234 *Calculus - Functions of Several Variables*		4	16
		E M A 201 *Statics*		3	
		BSE 249 *Engineering Principles for Biological Systems*		3	
		BSE 270 *Introduction to Computer Aided Design*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
2	Spring	BSE 349 *Biological Concepts for Engineers*		3	15
		MATH 320 *Linear Algebra and Differential Equations*		3	
		PHYSICS 202 *General Physics*		5	
		BSE 308 *Career Management for Engineers*		1	
		M E 306 *Mechanics of Materials*		3	
3	Fall	STAT 224 *Introductory Statistics for Engineers*		3	17
		BSE Course		2	
		M E 361 *Thermodynamics*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		300 level or higher non-BSE engineering course		3	
		Technical Elective		2	
3	Spring	E P D 397 *Technical Comm.* or other Comm B course		3	17
		BSE 508 *Biological Systems Engineering Design Practicum* I		2	
		M E 363 *Fluid Dynamics*		3	
		BSE 365 *Measurements and Instrumentation for Bio Systems*		3	
		BSE Course		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Fall	BSE 509 *Biological Systems Engineering Design Practicum II*		3	16
		BSE Course		3	
		300 level or higher non-BSE engineering course		3	
		Technical Elective		4	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Spring	BSE 464 *Heat and Mass Transfer in Biological Systems*		3	14
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		300 level or higher non-BSE engineering course		3	
		Technical Elective		3	
		Free Elective		2	
				Total	125

Notes: Need 125 credits to complete degree. If Chemistry 103 & 104 is taken in place of Chemistry 109, it is suggested to take Chemistry 103 in Fall semester and Chemistry 104 in Spring semester of year 1, and move ISyE 313 to the fall semester of year 2.

Four Year Road Map - Food and Bioprocess Engineering Specialization - Bioprocess Engineering Track

Yr	Sem.	Course	X	Crds	Sem. Total
1	Fall	MATH 221 *Calculus and Analytic Geometry*		5	15
		CHEM 109 *Advanced General Chemistry**		5	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		E P D 155 *Basic Communication* or other Comm A course		2	
1	Spring	MATH 222 *Calculus and Analytic Geometry*		4	14
		COMP SCI 310 *Problem Solving Using Computers*		3	
		INTEREGR 170 *Design Practicum*		2	
		MICROBIO 101 *Biology of Microorganisms*		3	
		MICROBIO 102 *General Microbiology Laboratory*		2	
2	Fall	MATH 234 *Calculus - Functions of Several Variables*		4	15
		BSE 249 *Engr. Princ. Bio Systems / CBE 250 Process Synthesis*		3	
		E M A 201 *Statics*		3	
		BSE 270 *Introduction to Computer Aided Design*		2	
		CHEM 343 *Introductory Organic Chemistry*		3	
2	Spring	BSE 349 *Biological Concepts for Engineers*		3	15
		PHYSICS 202 *General Physics*		5	
		BSE 308 *Career Management for Engineers*		1	
		MATH 320 *Linear Algebra and Differential Equations*		3	
		E P D 397 *Technical Comm.* or other Comm B course		3	
3	Fall	M E 361 *Thermodynamics* / CBE 310 *Chemical Process Thermo*		3	15
		STAT 224 *Introductory Statistics for Engineers*		3	
		BSE 367 *Renewable Energy Systems*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		BIOCHEM 501 *Introduction to Biochemistry*		3	
3	Spring	M E 363 *Fluid Mechanics* / CBE 320 *Transport Phenomena*		3-4	17-18
		BSE 364 *Engr. Properties of Food and Biological Materials*		3	
		BSE 365 *Measurements and Instrumentation for Bio Systems*		3	
		Technical Electives		3	
		BSE 508 *Biological Systems Engineering Design Practicum* I		2	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Fall	BSE 509 *Biological Systems Engineering Design Practicum II*		3	17-18
		I SY E 313 *Engineering Economic Analysis*		3	
		BSE 461 *Food and Bioprocessing Operations*		3	
		BSE 460 *Biorefining*		3	
		Technical electives		2-3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Spring	BSE 464 *Heat and Mass Transfer in Biological Systems*		3	15
		Free Electives		3	
		Humanities/Social Science/Ethnic Studies/International Studies		6	
		BSE Breadth Requirement Course		3	
				Total	125

Notes: Need 125 credits to complete degree. If Chemistry 103 & 104 is taken in place of Chemistry 109, it is suggested to take Chemistry 103 in Fall semester and Chemistry 104 in Spring semester of year 1, and move Microbio 101/102 to the first semester of year 2

Four Year Road Map - Food and Bioprocess Engineering Specialization - Food Engineering Track

Yr	Sem.	Course	X	Crds	Sem. Total
1	Fall	MATH 221 *Calculus and Analytic Geometry*		5	15
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		CHEM 109 *Advanced General Chemistry**		5	
		E P D 155 *Basic Communication* or other Comm A course		2	
1	Spring	MATH 222 *Calculus and Analytic Geometry*		4	15
		INTEREGR 170 *Design Practicum*		2	
		COMP SCI 310 *Problem Solving Using Computers*		3	
		MICROBIO 101 *Biology of Microorganisms*		3	
		I SY E 313 *Engineering Economic Analysis*		3	
2	Fall	MATH 234 *Calculus - Functions of Several Variables*		4	16
		BSE 249 *Engr. Princ. Bio Systems / CBE 250 Process Synthesis*		3	
		E M A 201 *Statics*		3	
		CHEM 343 *Introductory Organic Chemistry*		3	
		BSE 270 *Introduction to Computer Aided Design*		3	
2	Spring	BSE 349 *Biological Concepts for Engineers*		3	15
		PHYSICS 202 *General Physics*		5	
		BSE 308 *Career Management for Engineers*		1	
		MATH 320 *Linear Algebra and Differential Equations*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
3	Fall	M E 361 *Thermodynamics* / CBE 310 *Chemical Process Thermo*		3	15
		E P D 397 *Technical Comm.* or other Comm B course		3	
		FOOD SCI 410 *Food Chemistry*		3	
		STAT 224 *Introductory Statistics for Engineers*		3	
		MICROBIO 325 *Food Microbiology*		3	
3	Spring	FOOD SCI 432 *Principles of Food Preservation*		3	14-15
		BSE 364 *Engr. Properties of Food and Biological Materials*		3	
		BSE 508 *Biological Systems Engineering Design Practicum* I		2	
		M E 363 *Fluid Mechanics* / CBE 320 *Transport Phenomena*		3-4	
		BSE 365 *Measurements and Instrumentation for Bio Systems*		3	
4	Fall	BSE 509 *Biological Systems Engineering Design Practicum II*		3	16-17
		FOOD SCI 532 *Integrated Food Manufacturing*		4	
		Technical Electives		3-4	
		BSE 461 *Food and Bioprocessing Operations*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Spring	BSE Breadth Requirement Course		3	18
		BSE 464 *Heat and Mass Transfer in Biological Systems*		3	
		Technical Electives		3	
		Humanities/Social Science/Ethnic Studies/International Studies		6	
		Free Electives		3	
				Total	125

Notes: Need 125 credits to complete degree. If Chemistry 103 & 104 is taken in place of Chemistry 109, it is suggested to take Chemistry 103 in Fall semester and Chemistry 104 in Spring semester of year 1, and move ISyE 313 to year 2.

Four Year Road Map
Machinery Systems Engineering Specialization

Yr	Sem.	Course	X	Crds	Sem. Total
1	Fall	MATH 221 *Calculus and Analytic Geometry*		5	15
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		CHEM 109 *Advanced General Chemistry**		5	
		E P D 155 *Basic Communication* or other Comm A course		2	
1	Spring	MATH 222 *Calculus and Analytic Geometry*		4	16
		PHYSICS 202 *General Physics*		5	
		COMP SCI 310 *Problem Solving Using Computers*		3	
		INTEREGR 170 *Design Practicum*		2	
		M E 231 *Intro Engineering Graphics*		2	
2	Fall	MATH 234 *Calculus - Functions of Several Variables*		4	16
		E M A 201 *Statics*		3	
		BSE 249 *Engineering Principles for Biological Systems*		3	
		Biological Science Course		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
2	Spring	BSE 349 *Biological Concepts for Engineers*		3	17
		BSE 308 *Career Management for Engineers*		1	
		E M A 202 *Dynamics*		3	
		M E 361 *Thermodynamics*		3	
		M E 306 *Mechanics of Materials*		3	
		M E 307 *Mechanics of Materials Lab*		1	
		STAT 224 *Introductory Statistics for Engineers*		3	
3	Fall	MATH 320 *Linear Algebra and Differential Equations*		3	15
		BSE 270 *Introduction to Computer Aided Design*		3	
		BSE 475 *Engineering Principles of Agr. Machines*		3	
		M E 363 *Fluid Dynamics*		3	
		I SY E 313 *Engineering Economic Analysis*		3	
3	Spring	E P D 397 *Technical Comm.* or other Comm B course		3	17
		BSE 476 *Engineering Principles of Off-Road Vehicles*		3	
		BSE 508 *Biological Systems Engineering Design Practicum* I		2	
		M E 313 *Manufacturing Processes*		3	
		M E 340 *Dynamic Systems*		3	
		BSE 365 *Measurements and Instrumentation for Bio Systems*		3	
4	Fall	BSE 509 *Biological Systems Engineering Design Practicum II*		3	14
		M E 342 *Design of Machine Elements*		3	
		Technical Electives		5	
		BSE Breadth Requirement Course		3	
4	Spring	Technical Electives		9	15
		Humanities/Social Science/Ethnic Studies/International Studies		6	
		Free Electives		3	
				Total	125

Notes: Need 125 credits to complete degree. If Chemistry 103 & 104 is taken in place of Chemistry 109, it is suggested to take Chemistry 103 in Fall semester and Chemistry 104 in Spring semester of year 1, to move M E 231 to Fall semester of year 2.

Four Year Road Map
Natural Resources and Environmental Engr Specialization

Yr	Sem.	Course	X	Crds	Sem. Total
1	Fall	MATH 221 *Calculus and Analytic Geometry*		5	15
		Humanities/Social Science/Ethnic Studies/International Studies		3	
		CHEM 109 *Advanced General Chemistry**		5	
		E P D 155 *Basic Communication* or other Comm A course		2	
1	Spring	MATH 222 *Calculus and Analytic Geometry*		4	15
		Soils Sci 230 *Soil: Ecosystem and Resource*		3	
		INTEREGR 170 *Design Practicum*		2	
		COMP SCI 310 *Problem Solving Using Computers*		3	
		Biological Science Course		3	
2	Fall	MATH 234 *Calculus - Functions of Several Variables*		4	17
		E M A 201 *Statics*		3	
		BSE 201 *Land Surveying Fundamentals*		1	
		BSE 249 *Engineering Principles for Biological Systems*		3	
		Technical Elective		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
2	Spring	BSE 349 *Biological Concepts for Engineers*		3	15
		PHYSICS 202 *General Physics*		5	
		BSE 472 *Sediment & Bio-Nutrient Engr. & Management*		3	
		STAT 224 *Introductory Statistics for Engineers*		3	
		BSE 308 *Career Management for Engineers*		1	
3	Fall	MATH 320 *Linear Algebra and Differential Equations*		3	16
		I SY E 313 *Engineering Economic Analysis*		3	
		CIV ENGR 310 *Fluid Mechanics*		3	
		BSE 372 *On-Site Waste Water Treatment*		2	
		BSE 473 *Irrigation and Drainage System Design*		2	
		Technical Elective		3	
3	Spring	E P D 397 *Technical Comm.* or other Comm B course		3	17
		BSE 508 *Biological Systems Engineering Design Practicum* I		2	
		E M A 303 *Mechanics of Materials*		3	
		BSE 571 *Small Watershed Engineering*		3	
		BSE 365 *Measurements and Instrumentation for Bio Systems*		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Fall	BSE 509 *Biological Systems Engineering Design Practicum II*		3	15
		M E 361 *Thermodynamics*		3	
		Technical Elective		3	
		BSE Breadth Requirement Course		3	
		Humanities/Social Science/Ethnic Studies/International Studies		3	
4	Spring	Technical Electives		6	15
		Humanities/Social Science/Ethnic Studies/International Studies		6	
		Free Elective		3	
				Total	125

Notes: Need 125 credits to complete degree. If Chemistry 103 & 104 is taken in place of Chemistry 109, it is suggested to take Chemistry 103 in Fall semester and Chemistry 104 in Spring semester of year 1, and move Biological Science to the fall semester of year 2. Soil Sci 301 is offered Fall semesters and is a 4 credit alternative to Soil Sci 230. Plan BSE 473 for Fall term of year 3 or 4 as available in odd years.

Capstone Course Enrollment Requirement

BSE 508 *Biological Systems Engineering Design Practicum I* and BSE 509 *Biological Systems Engineering Design Practicum II* collectively comprise the Department's capstone design experience. BSE 509 is to be taken by students during their last fall semester of enrollment (and not before), with BSE 508 taken the previous spring. Students are assigned to a project and design team during BSE 508, and complete work on the project during BSE 509. In order to get a final grade in BSE 509, a student must also have taken the Fundamentals of Engineering (FE) exam.

The fixed sequence and timing (with respect to graduation) of BSE 508 and BSE 509 mean that they will occasionally conflict with a student's study abroad or internship experience. In such cases, provisions can be made to take the conflicting course remotely while abroad and/or interning off campus.

Although all students must take BSE 508, a student can opt out of BSE 509 by completing a design project totally independent of BSE 509. To get the BSE 509 requirement formally waived, a student must submit (for review by faculty affiliated with BSE 509) a final written design project report and a design notebook (in hard or electronic form). The student is also required to present their design via a poster presentation and/or oral presentation, and they must have taken the FE exam. This policy is in place to encourage creative students to participate in on- and off-campus design competitions that do not allow entry of classroom projects. It is important to note that a student does not receive degree credits for BSE 509 when it is waived in this manner.

K. Programming Policies, Options and Recommendations

Mandatory Contact with Advisors

Each semester 3 to 4 weeks prior to enrollment for the following semester's courses the BSE Department places a hold on your registration. This hold is not removed until your advisor approves your proposed plan of study for the following semester. This process begins when you email an updated curriculum checklist to your advisor. An updated curriculum checklist is one that not only shows what courses you have completed and are currently taking, but also what courses you plan on taking the following semester(s). You are encouraged to also use the Degree Planner tool within Course Guide.

Once your advisor is satisfied with your future plan of study, he/she will notify the BSE Student Services Coordinator who will remove your registration hold. *You will not be able to register until this hold is removed.* Not all departments use such registration holds, but we feel it is extremely important that you visit with your advisor each semester about your future class schedule.

If a hold still exists after you have talked to your advisor, please make sure the hold relates to the next semester and not a later semester. You may be able to register for the up-coming semester but not for semesters after that. Also, holds may be placed on your record that are not advisor holds but relate to some other issue.

Course Substitutions

Students who transfer into the BSE program have often taken one or more courses prior to transfer that are similar, but do not carry the same course number(s) as the listed BSE curricular requirement. This is frequently the case with statistics and physics courses.

With respect to statistics, the BSE Department will generally approve as a substitution for STAT 224 or STAT 324, any AP statistics or college level statistics course of three or more credits. This substitution recognizes the fact that on the UW-Madison campus, a student can generally not receive degree credit for more than one introductory statistics course (i.e., a student can only receive credit one of the following courses: STAT 201, 224, 301, 324, and 371).

The BSE Department does not allow a first semester physics course to be used to meet its statics requirement (i.e., EMA 201). Students who have taken a first semester physics course, whether calculus based or not, should count it as a Category D Technical Elective.

For its second semester physics requirement (i.e., Physics 202), the department will allow the substitution of any other calculus-based physics course of four or more credits. A non-calculus based physics course may be substituted for the calculus based physics requirement provided it was taken prior to transfer into the BSE program and is equivalent to Physics 104 on the UW-Madison campus.

A student transferring into BSE does not have to take BSE 249 *Engineering Principles for Biological Systems* if they have already completed ME 361 *Thermodynamics* or CBE 310 *Chemical Process Thermodynamics*. Instead, in place of BSE 249 the student can substitute a course that would otherwise count as a Category C tech elective. Note that the course substituted for BSE 249 can not also be counted as a Category C tech elective.

Any student who desires a particular course substitution (including those previously described) must complete a *Request for DARS Exception* form and submit it to their advisor. The request, if approved by the BSE Undergraduate Instruction and Program Committee (UIPC), will be forwarded to the CALS Dean for Academic Affairs where it must be approved by the Dean and/or the CALS SPAC (Scholastic Policies and Actions Committee).

Semester Credit Load Recommendations

The number of credits in which you enroll may be influenced by a number of factors. Chief among these is typically the cost of college. At UW-Madison, undergraduate tuition is the same for a student taking 12 credits as it is for a student enrolled in 18 course credits. Students taking fewer than 12 credits essentially pay by the credit. There is a surcharge for credits taken in excess of 18. In addition, any student who desires to enroll in more than 18 credits must obtain permission from their advisor and the CALS Office of Academic Affairs.

Given the fee structure, students are encouraged to enroll in ***at least*** 15 credits per semester. Note that it takes 2 extra semesters to accumulate 120 credits when you take 12 credits per semester instead of 15. Also keep in mind that educational expenses continually increase, and thus the last year you spend in school is likely to be the most expensive.

Students working on- or off-campus often reduce their academic load in proportion to the time they spend working. In some cases, students opt to enroll as part-time students. Since a student's earning power generally increases sharply once they obtain a professional engineering degree, it is often not in a student's long-term financial interest to work while attending school when such work results in a reduced academic work load which extends their time-to-degree. In many cases, it pays to take out a loan to complete school – a loan that can be rapidly repaid once a student is professionally employed. When making school versus work decisions, keep in mind that the cost of room and board (which exist whether or not one is an enrolled student) are generally very near to the cost of tuition.

Students who are struggling to meet the requirements for ABE classification, may want to take a reduced work load that enables them to put extra effort into improving their GPA.

A student on academic probation is advised to carry no more than 14 credits per semester unless repeating a course. For every three credits being repeated, the student is advised to carry not more than one additional credit beyond 14, up to a maximum of 16 credits.

Taking Courses Pass/Fail

Only courses that will count as ***free*** electives under the BSE curriculum can be taken pass/fail. Courses graded with the pass/fail system cannot be used to satisfy any of the university, college, degree program, or major requirements. Continuing students with at least a 2.0 cumulative GPA, new freshmen, and new

transfer students may elect one pass/fail course each semester, with a maximum of eight such courses prior to graduation.

After approval, the student cannot change the grading back to the conventional (A, AB, etc.) basis. The grade is excluded from the GPA. Students are warned that although a grade of D carries credit under the conventional system, it carries no degree credit when it is converted to a grade of U under the pass/fail privilege.

Farm and Industry Short Course Credits

The College of Agriculture and Life Science (CALS) administers a Farm and Industry Short Course (FISC). A number of FISC courses are taught by BSE faculty and staff. The policy within CALS is that a B.S. degree student who has taken FISC classes, or a FISC student now pursuing a four-year degree from CALS, may apply a maximum of 15 FISC credits toward their degree. To do this, a student must request a transcript from the FISC office (116 Ag Hall, 608-263-3918) and ask to have the credits transferred.

Some FISC courses contain content that is not available in other UW-Madison courses but is relevant to a student's BSE program. As a BSE major, it is possible to petition to have these particular FISC courses counted as technical elective credit.

Double Majors and Dual Degrees

The difference between a "major" and a "degree" is not clear to most students and faculty and thus there is confusion between what it means to *double major* and what it means to *dual degree*. A *major* is defined as a field of academic study in which one concentrates or specializes. A *degree* is an award conferred by a college or university signifying that the recipient has satisfactorily completed a specific course of study.

At UW-Madison, students who specialize (i.e., major) in biological systems engineering receive a Bachelor of Science – Biological System Engineering degree when they complete all requirements for the degree. This is the only degree available to a student majoring in BSE. This B.S. in BSE is one of three professional degrees available in CALS, the other two being a B.S in Agricultural Business Management or a B.S. in Dietetics. All other CALS majors (agricultural and applied economics, life sciences communication, agronomy, animal sciences, community and environmental sociology, dairy science, entomology, food science, horticulture, plant pathology, poultry science, soil science, etc.) receive a Bachelor of Science degree.

A student who is *double majoring* is specializing in two different areas but receiving only one degree. The degree that a student is pursuing dictates the areas in which the student can officially double major. Students majoring in BSE (and thus pursuing a B.S. in Biological Systems Engineering) can not double major in another engineering field, nor can they double major in business or in another CALS discipline. BSE majors may earn an additional major in the College of Letters and Science and have the additional major noted on their transcript at the time of graduation. To qualify, the student must have approval in advance from both the department in the College of Letters and Science offering the major and the academic dean of the CALS, and must satisfy all requirements for the Letters and Science major by the time the engineering degree is completed. Engineering students frequently earn additional majors in math, physics, or computer science--subjects that overlap efficiently with engineering curricula. By working closely with academic advisers, students can incorporate majors in other interest areas but should be prepared to extend their time to graduation to accommodate the extra credits. Note that students who double major **within CALS** are simultaneously meeting the requirements that two different major areas have or the **same** CALS degree. For example, a student receiving a B.S. from CALS could double major in both agronomy and plant pathology by simultaneously meeting all requirements that agronomy and plant pathology have established for their B.S. degree.

A student who is a dual degree candidate is simultaneously pursuing two different degrees. To obtain a second degree, all requirements for both degrees must be met, with the minimum total number of credits required equal to 30 more than the minimum number of credits required for the two degrees. This means if a student elects to complete a second degree that by itself requires a minimum of 120 credits (which is less than the 125 required for a B.S. in BSE), then the minimum total required for the dual degree would be 150 credits (120 + 30). A student must have an advisor in both major fields. To work on two degrees simultaneously within the college, a student should seek permission as *early as possible* to ensure that it is feasible to complete both degrees. If the two degrees to be earned are from two different colleges (one degree in Agricultural and Life Sciences and one degree in another school or college on this campus), the undergraduate dean in both colleges must approve the student's plan. Note that not all colleges will allow dual degrees.

Although BSE students can double degree if they so chose, they are highly discouraged from doing so for two main reasons. First, the number of credits required for a second degree (25 to 30 credits for a BSE student) is similar to the 30 credits required for a master's degree, and (1) relative to a second undergraduate degree, a master's degree is typically looked upon more favorably by employers, and (2) the course of study for the typical master's degree is not as restrictive as it is for a bachelor's degree (meaning that you get to take more of the classes YOU want to take). Second, by the year 2020, it is quite likely that most states will require individuals applying for a professional engineering license to have an engineering education equivalent to that of a master program at a major engineering school.

Certificate Programs

Few BSE students double major and even fewer pursue a second undergraduate degree. Far more common are BSE students who obtain certificates. Certificate programs - some of which are called “areas of emphasis,” “concentrations,” or “professional development programs,” - are small sets of courses, often from more than one department, which focus on a given topic. These programs are offered in addition to traditional major and degree programs, although the courses carried may also count toward the completion of major and degree requirements. With their emphasis on a theme, and their interdisciplinary approach, certificate programs are of increasing interest to students. The opportunity they provide to pursue an area of interest and to achieve recognition for its mastery over-and-above, but concurrently with a regular academic program, also adds value to a student's educational experience. Courses which are "packaged", so to speak, into a certificate program, offer recognition for unified segments of course work while the student pursues a traditional degree program. Nevertheless, certificate programs are not degree programs, and in many cases, they will prolong the time it takes to receive an undergraduate degree.

The College of Engineering offers a Certificate in Biology in Engineering, a Certificate in International Engineering, and a Certificate in Japanese Studies and Technical Communications. The College of Agriculture and Life Sciences offers the CALS Leadership Certificate and the CALS International Certificate. The Gaylord Nelson Institute for Environmental Studies (Nelson Institute) offers a Certificate in Environmental Studies. The School of Business offers a Certificate in Business (CIB) for non-business students. The CIB program provides non-business students the opportunity to earn a concentration in a clearly defined academic program in business. Admission to the CIB program is highly competitive and requires an application. The College of Letters and Sciences offers numerous certificate programs. The Holtz Center for Science & Technology Studies offers the certificate in Integrated Studies in Science, Engineering, and Society Undergraduate (ISSuES). ISSuES was designed to help STEM-field majors fulfill their liberal arts requirements and offers undergraduate students an opportunity to explore the social sciences and humanities in a way that emphasizes the relationship between science, technology, medicine, engineering, and society. For more information on certificate programs, including a complete list of UW-Madison certificate programs, see: http://www.wisc.edu/academics/certificates/

Advanced Degrees

As the flagship institution in the UW-System, UW-Madison has a world renowned graduate school that offers numerous advanced degrees. For this reason, few UW-Madison students pursue a second undergraduate degree. As previously noted, when compared to a second undergraduate degree, a Masters degree allows students greater flexibility with respect to course selection (i.e., Master's students essentially design their own curriculums whereas undergraduate degree programs are fairly rigid except with respect to technical elective selection), and is more prestigious/influential. Additionally, up to six credits of science/engineering classes taken at 400-level and above as UW-Madison undergraduate can be counted toward meeting the requirements for a Master's degree. For more information on BSE graduate work see the BSE Graduate Student Handbook located at http://bse.wisc.edu/ under the Graduate tab.

L. Scholarships and Financial Aid

The College of Agricultural and Life Sciences administers all scholarships that are awarded to students within its college. Application for scholarships within CALS is from late October to early February for the following academic year. The actual application is found at Scholarships @UW-Madison through your student center. By filling out this one application, you will be eligible for all awards offered in CALS. This includes a number of scholarships that are only awarded to BSE students. Recipients of these BSE-only scholarships are selected by the BSE teaching faculty. It is important to emphasize that if you want to be eligible for one of these scholarships, you must complete the application found at Scholarships @UW-Madison by February 1. All students are encouraged to apply.

M. ASABE Pre-Professional Club

It is extremely beneficial for students to join student organizations to learn about their chosen profession and to develop leadership skills. This type of activity is highly regarded by potential employers. Without it you may be overlooked, even though you have a very good GPA. Joining and actively participating in the American Society of Agricultural and Biological Engineers (ASABE) Pre-Professional Club is an excellent way to meet other students and faculty, to learn about your profession, to meet people from industry, and to learn about job opportunities. The Club meets monthly with announcements posted in the Agricultural Engineering Building and sent to you via e-mail. In early September, the faculty and staff host a student/faculty/staff mixer in the Agricultural Engineering Lab Building for all Biological Systems Engineering majors. Please participate. Your participation in the Pre-Professional Club will pay large dividends when it comes time to apply for employment.

N. General Program Option Sample Curricula

The general program option was designed to enable students to put together specialty programs within the agricultural and biological systems engineering area that meet engineering program accreditation requirements.

One use of the General Program Option would be to assemble a curriculum that combines several courses from the three main specialization areas within the UW-Madison BSE program (i.e., Natural Resources and Environment Engineering, Food and Bioprocess Engineering, and Machinery Systems Engineering). In this respect, the General Program Option provides a general study of Biological Systems Engineering.

The General Program Option can also be used to assemble a curriculum targeted at a very specific occupation or area of study within the profession. This could be an occupation in an emerging area of study, or a fairly well-established and/or well-defined occupation.

Following are suggested curricula (under the general program option) for structural engineering, construction engineering and management, and facilities operations engineering and management. Others will be added as they are formulated by faculty, students, and/or others interested in a specialty area within the program.

Structural Engineering

Structural Engineers are responsible for ensuring that buildings and other structures do not fail under imposed loads. This work includes (1) calculation of static and dynamic forces due to stored materials, material handling and processing equipment, snow, wind, earthquakes, soil, temperature and moisture content changes, rain, vehicles, etc., (2) foundation and structural frame analysis, (3) design of foundations, silos, bins, cooling towers, structural frames, and (4) selection, sizing, and connection detailing for wood, steel, reinforced concrete and masonry components.

The involvement of structural engineers in large building design is essential. Government-enforced codes require commercial building plans to be stamped/sealed by engineers that are professionally registered. Several states require that engineers who stamp/seal plans for larger structures be registered as *structural* engineers, which in turn requires that the engineers pass special structural engineering exams.

In addition to fundamental engineering courses, structural engineers must take courses in structural analyses; wood design, steel design, reinforced concrete design, soil mechanics, building materials, building codes and loads, seismic engineering, etc. Most registered structural engineers carry a master's degree in engineering.

General Program Option for Structural Engineering

Credits	Course Number	Course Title
Required Courses		
3	CIV ENGR 310 or ME 363	Fluid Mechanics/Dynamics
3	ME 361	Thermodynamics
3	BSE 464	Heat and Mass Transfer in Biological Systems
3	EMA 303 or ME 306	Mechanics of Materials
Minimum of Three BSE Courses (suggested)		
1	BSE 201	Land Surveying Fundamentals
3	BSE 372	On-Site Waste Water Treatment and Dispersal
3	BSE 367	Renewable Energy Systems
Minimum of Nine Credits of non-BSE Engineering Courses w/ 300 or higher course number (suggested)		
3	CIV ENGR 330	Soil Mechanics
3	CIV ENGR 340	Structural Analysis
3	CIV ENGR 442	Wood Structures I
3	CIV ENGR 447	Concrete Structures I
Category A Tech Elective - Intro to Engr Course (suggested)		
2	InterEGR 170	Design Practicum
Category C Tech Elective - Upper-Level Engineering and Science Courses (suggested)		
3	CIV ENGR 395	Materials for Constructed Facilities
2	CIV ENGR 392	Building Information Modeling
3	E P D 397	Technical Communications
Category D Tech Elective - Lower-Level Engineering and Science Courses, Breadth Courses (suggested)		
3	CIV ENGR 290	Construction Systems
44	TOTAL	

Construction Engineering and Management

Construction Engineers and Managers handle the overall planning, coordination, and control of a construction project from beginning to completion. This involves (1) specifying project objectives and plans including budgeting, scheduling, establishing performance requirements, and selecting participating contractors, (2) maximizing the efficient use of available labor, materials and equipment, (3) implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process, and (4) establishing effective lines of communication and effective mechanisms for conflict resolution.

With respect to agriculture, Construction Engineers and Managers get involved in both on-farm and post-harvest storage and/or processing facilities. The later can include port terminals, pet food processing plants, feed mills (general, bovine, fish, mink, swine, poultry, etc.), flour mills, grain handling and storage facilities, meat processing plants, canning factories, bottling plants (milk, soda, fruit juice, etc.), malting plants, breweries, sawmills, paper mills, ethanol and other biomass plants, textile mills, seed processing facilities, bakeries, confectionaries, cheese factories, and thousands of other food and bioprocessing facilities.

General Program Option for Construction Engineering and Management

Credits	Course Number	Course Title
Required Courses		
3	CIV ENGR 310 or ME 363	Fluid Mechanics/Dynamics
3	ME 361	Thermodynamics
3	BSE 464	Heat and Mass Transfer in Biological Systems
3	EMA 303 or ME 306	Mechanics of Materials
Minimum of Three BSE Courses (suggested)		
1	BSE 201	Land Surveying Fundamentals
3	BSE 372	On-Site Waste Water Treatment and Dispersal
3	BSE 367	Renewable Energy Systems
Minimum of 9 Credits of non-BSE Engineering Courses w/ 300 or higher course number. (suggested)		
3	CIV ENGR 492	Integrated Project Estimating and Scheduling
3	CIV ENGR 496	Electrical Systems for Construction
3	CIV ENGR 497	Mechanical Systems for Constructions I
3	CIV ENGR 498	Construction Project Management
Category A Tech Elective - Intro to Engr Course (suggested)		
2	InterEGR 170	Design Practicum
Category C Tech Elective - Upper-Level Engineering and Science Courses (suggested)		
3	CIV ENGR 395	Materials for Constructed Facilities
2	CIV ENGR 392	Building Information Modeling
Category D Tech Elective - Lower-Level Engineering and Science Courses, Breadth Courses. Take enough Cat D tech electives to bring total specialization credits to 43. Note that GEN BUS 310 can be used to fulfill the engineering economics requirement (in which case it would not count here).		
3	CIV ENGR 290	Construction Systems
3	GEN BUS 301	Business Law
3	GEN BUS 310	Fundamentals of Accounting and Finance for Non-Business Majors (also counts as a social science course)
3	GEN BUS 311	Fundamentals of Management and Marketing for Non-Business Majors (also counts as a social science course)
3	REAL EST 306	The Real Estate Process (also counts as a social science course)

Facilities Operations Engineering and Management

Facilities Operations Engineering and Management is focused on improving operational efficiencies, facility maintenance (e.g., inspection techniques and schedules, equipment replacement), and maintaining a safe working environment for all plant personnel. Specific working titles in this field include: operations engineer, maintenance engineer, quality control (QC) engineer, environmental health and safety (EH&S) engineer, and process electrical engineer. Operations engineers (which generally includes engineers with such titles as industrial engineer, process engineer, industrial process engineer, and manufacturing engineer) are generally responsible for continual adherence to good manufacturing practices (GMP's), total quality management (TQM), and statistical quality management (SQM) principles. They frequently get involved in time and yield/productivity studies for improved line efficiencies and reduced waste, determination of break-even points, internal rate of return (IRR), and return on investment (ROI) for manufacturing processes/equipment. They define and prioritize new projects, design in-house equipment/process modifications, select equipment vendors, and establish training program requirements for operations, maintenance, sanitation, and logistics.

General Program Option for Facilities Operations Engineering and Management

Credits	Course Number	Course Title
Required Courses		
3	CIV ENGR 310 or ME 363	Fluid Mechanics/Dynamics
3	ME 361	Thermodynamics
3	BSE 464	Heat and Mass Transfer in Biological Systems
3	EMA 303 or ME 306	Mechanics of Materials
Minimum of three BSE Courses (suggested)		
1	BSE 201	Land Surveying Fundamentals
3	BSE 372	On-Site Waste Water Treatment and Dispersal
3	BSE 461	Food and Bioprocessing Operations
Minimum of Nine Credits of non-BSE Engineering Courses w/ 300 or higher course number (suggested)		
3	CIV ENGR 492	Integrated Project Estimating and Scheduling
3	CIV ENGR 496	Electrical Systems for Construction
3	CIV ENGR 497	Mechanical Systems for Constructions I
3	CIV ENGR 498	Construction Project Management
Category A Tech Elective - Intro to Engr Course (suggested)		
2	InterEGR 170	Design Practicum
Category C Tech Elective - Upper-Level Engineering and Science Courses (suggested)		
3	CIV ENGR 395	Materials for Constructed Facilities
2	CIV ENGR 392	Building Information Modeling
Category D Tech Elective - Lower-Level Engineering and Science Courses, Breadth Courses. Take enough Cat D tech electives to bring total specialization credits to 43. Note that GEN BUS 310 can be used to fulfill the engineering economics requirement (in which case it would not count here).		
3	CIV ENGR 290	Construction Systems
3	GEN BUS 301	Business Law
3	GEN BUS 310	Fundamentals of Accounting and Finance for Non-Business Majors (also counts as a social science course)
3	GEN BUS 311	Fundamentals of Management and Marketing for Non-Business Majors (also counts as a social science course)
3	OTM 300	Operations Management
3	OTM 654	Production Planning and Control