BIOLOGICAL SYSTEMS ENGINEERING (BSE)

BSE 1 – COOPERATIVE EDUCATION PROGRAM
1 credit.

Full-time off-campus work experience which combines classroom theory with practical knowledge of operations to provide a background upon which to base a professional career.
Requisites: Consent of instructor
Course Designation: Workplace - Workplace Experience Course
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2023

BSE 170 – PRODUCT DESIGN PRACTICUM
2 credits.

Work in small groups to design, fabricate, and test a device that solves a real world problem. Includes retrieval techniques, specification writing, methods for enhancing creativity, selection methodologies, safety engineering, sustainability in design, shop safety, fabrication equipment and techniques, and oral and written communication.
Requisites: Declared in Biological Systems Engineering BS or classified as Pre-Biological Systems Engineering
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 243 – OPERATING AND MANAGEMENT PRINCIPLES OF OFF-ROAD VEHICLES
3 credits.

Principles of operation of internal combustion engines, fuel metering, cooling, lubrication, clutches, mechanical and hydrostatic transmissions, final drives, hydraulics systems and traction systems. Selection and management of off-road vehicles for agriculture, construction, lawncare and turfgrass industries.
Requisites: MATH 112, 114, or 217
Repeatable for Credit: No
Last Taught: Spring 2015

BSE 249 – ENGINEERING PRINCIPLES FOR BIOLOGICAL SYSTEMS
3 credits.

Applications of basic engineering principles such as mass and energy balances, psychrometric heat and mass transfer and fluid flow to problems encountered in agricultural and biological systems including grain conditioning, fruit and vegetable storage, food processing, animal housing, and environmental control.
Requisites: MATH 217, 221, or 275
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 270 – INTRODUCTION TO COMPUTER AIDED DESIGN
3 credits.

Introduction to computer aided design (CAD) concepts and techniques, including two- and three-dimensional drawing presentation, methods of graphic communication and design synthesis. Specific topics include parametric solid modeling, part design, survey data and surface construction, orthographic drawings, dimensioning rules and drawing standards, assemblies, and animation.
Requisites: None
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 289 – HONORS INDEPENDENT STUDY
1-2 credits.

Research work for Honors students under direct guidance of a faculty member in an area of Biological Systems Engineering. Students are responsible for arranging the work and credits with the supervising instructor.
Requisites: Consent of instructor
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions

BSE 299 – INDEPENDENT STUDY
1-3 credits.

Research work for students under direct guidance of a faculty member in an area of Biological Systems Engineering. Students are responsible for arranging the work and credits with the supervising instructor.
Requisites: Consent of instructor
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023

BSE 301 – LAND INFORMATION MANAGEMENT
3 credits.

An introduction to land information management through the principles of geospatial technologies and methods for analysis and interpretation of geospatial data. Includes both the basic land surveying technology and advanced remote observation of land resources by airborne and space-based sensors.
Requisites: MATH 113, 114, or 217
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 308 – CAREER MANAGEMENT FOR ENGINEERS
1 credit.

Develop engineering career and life skills in time management, housing selection, financial management, the job search process, professional networking, branding and social media presence, professional development and professional society membership, leadership, professional ethics, and registration/licensure. Understand future trends in digital technology, climate change, diversity, and sustainability and how they affect career opportunities in the engineering field.
Requisites: None
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023

BSE 310 – PROJECT ECONOMICS & DECISION ANALYSIS
3 credits.

Evaluation techniques for research, development engineering projects. Covers the time value of money and other cash-flow concepts, capital budgeting, economic practices and techniques used to evaluate and optimize decisions, and research development project portfolio management techniques.
Requisites: MATH 113, 114, or (MATH 171 and 217)
Course Designation: Breadth - Social Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2023

BSE/AN SCI 344 – DIGITAL TECHNOLOGIES FOR ANIMAL MONITORING
3 credits.

Introduces key concepts of sensor technology used for livestock and companion animal monitoring and veterinary medicine. Describes applications of Artificial Intelligence (AI) systems for livestock animals and veterinary medicine, including animal monitoring, computer-aided diagnosis, and optimized farm management decisions.
Requisites: (MATH 112, 114, 171, or placement into MATH 221) or graduate/professional standing
Repeatable for Credit: No

BSE 349 – QUANTITATIVE TECHNIQUES FOR BIOLOGICAL SYSTEMS
3 credits.

Principles of how energy and materials are utilized in Cells, organisms and ecosystems. Mass transfer, heat and energy balances applied to cell metabolism, plants, and ecosystems. Quantification of biological processes to allow manipulation for human benefit.
Requisites: MATH 222, (CHEM 104, 109, or 116), and (BOTANY/BIOLOGY/ZOOLOGY 151, ZOOLOGY 153, ZOOLOGY/BIOLOGY 101, BOTANY/BIOLOGY 130, MICROBIO 101, or ENVIR ST/BOTANY/ZOOLOGY 260)
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 351 – STRUCTURAL DESIGN FOR AGRICULTURAL FACILITIES
3 credits.

Introduction to agricultural building codes and loads; structural analysis; wood, concrete and soil properties; wood and reinforced concrete design; construction specifications.
Requisites: EMA 201 or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

BSE 364 – ENGINEERING PROPERTIES OF FOOD AND BIOLOGICAL MATERIALS
3 credits.

Study of various physical, mechanical, thermal and other properties of food and biological materials. Importance of such property values on the design and operation of various food and bioprocess engineering systems.
Requisites: (BSE 249 or CBE 250) and (M E 361 or CBE 310)
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 365 – MEASUREMENTS AND INSTRUMENTATION FOR BIOLOGICAL SYSTEMS
3 credits.

Principles of instrumentation and measurement systems, analysis of experimental data, electronic components, instrumentation for measuring various parameters of biological systems (e.g., temperature, force, flow).
Requisites: Declared in Biological Systems Engineering or Environmental Engineering BS
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

BSE/ENVIR ST 367 – RENEWABLE ENERGY SYSTEMS
3 credits.

Learn about the state-of-the-art in renewable energy applications including biomass for heat, electric power and liquid fuels as well as geo-energy sources such as wind, solar, and hydro power. Practice engineering calculations of power and energy availability of renewable energy sources and learn about requirements for integrating renewable energy sources into production, distribution and end-use systems.
Requisites: MATH 112, 114, 217, placement into MATH 221, or graduate/professional standing
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

BSE/CIV ENGR/SOIL SCI 372 – ON-SITE WASTE WATER TREATMENT AND DISPERSAL
2 credits.

On-site treatment and dispersal of waste water from homes, commercial sources and small communities. Sources, pretreatment units, nutrient removal units, constructed wetlands, surface and soil dispersal systems, recycle and reuse systems, regulations, alternative collection systems.
Requisites: CHEM 103, 109, or 115
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 375 – SPECIAL TOPICS
1-4 credits.

Specialized subject matter of current interest to undergraduate students.
Requisites: None
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2022

BSE 380 – INTRODUCTORY DATA SCIENCE FOR THE AGRICULTURAL AND LIFE SCIENCES
3 credits.

Agricultural and life scientists need to creatively apply physical, chemical, and biological principles to address technical, business, and environmental challenges. Many of these challenges involve numerical analyses, including the interpretation of large datasets. The fundamentals of computer coding using numerical software will be taught, using real-world data science challenges from the agricultural and life sciences.
Requisites: (CHEM 103, 109, or 115) and (MATH 112, 114, 217 or placement into MATH 211 or 221)
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 399 – COORDINATIVE INTERNSHIP/COOPERATIVE EDUCATION
1-8 credits.

An internship under the guidance of a faculty or instructional academic staff member in BSE and internship site supervisor. Students are responsible for arranging the work and credits with the faculty or instructional academic staff member and the internship site supervisor.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Workplace - Workplace Experience Course
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2022

BSE 400 – STUDY ABROAD IN BIOLOGICAL SYSTEMS ENGINEERING
1-6 credits.

Provides an area equivalency for courses taken on Madison Study Abroad Programs that do not equate to existing UW courses. Enrollment in a UW-Madison resident study abroad program
Requisites: None
Repeatable for Credit: Yes, unlimited number of completions

BSE 405 – INTELLIGENCE AND AUTOMATION IN AGRICULTURE
3 credits.

The promise of digital agriculture is the ability to evaluate the system on a holistic basis and generate tools that allow for improved decision making in every sub-process. Rapid developments in machinery have expanded the scale, speed, and productivity of agricultural machines. Recent advances in sensors, mechatronics and data computing technologies will increase agricultural productivity and build sustainability. Topics related to data acquisition and processing with agricultural intelligent systems will be covered.
Requisites: BSE 380, COMP SCI 310, or graduate/professional standing
Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 460 – BIOREFINING: ENERGY AND PRODUCTS FROM RENEWABLE RESOURCES
3 credits.

Concepts, processes, status quo and future direction of biorefining for production of energy (fuels), chemicals and materials from biomass, with emphases on chemical, biological and engineering aspects of the biorefining.
Requisites: (CHEM 104 or 109) and (CHEM 341 or 343), or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 461 – FOOD AND BIOPROCESSING OPERATIONS
3 credits.

Principles of mechanics, fluid dynamics, and heat and mass transfer as applied to food and bioprocessing operations. Specific focus on unit operations and equipment associated with the products key to Wisconsin industries including pulp and paper, dairy products, ethanol, forage, and grain.
Requisites: (BSE 249 or CBE 250), (CIV ENGR 310, CBE 320, or M E 363), or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 464 – HEAT AND MASS TRANSFER IN BIOLOGICAL SYSTEMS
3 credits.

Introduction to heat and mass transfer fundamentals, including transport mechanisms of conduction, convection, radiation, diffusion and evaporation. Development of governing equations and boundary conditions with application to living systems, controlled environments, water systems, and food processing. Introduction to, and application of, finite-difference and finitevolume methods, including computational fluid dynamics (CFD).
Requisites: (M E 361 or CBE 310) and (M E 363, CBE 320, or CEE 310)
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 472 – SEDIMENT AND BIO-NUTRIENT ENGINEERING AND MANAGEMENT
3 credits.

Hydrologic, biologic and engineering applications in the design and management of sediment and bio-nutrient control systems.
Requisites: Junior standing
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 473 – WATER MANAGEMENT SYSTEMS
3 credits.

Engineering and management applications of soil-plant-water relationships applied to water management systems and efficient water use.
Requisites: MATH 217, 221, 275, or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

BSE/M E 474 – FLUID POWER
3 credits.

Engineering principles of design and analysis of fluid power systems and fluid power components. Topics include hydraulic fluid properties, fluid flow and, positive displacement pumps, valves for pressure, flow, and directional control, linear and rotary actuators, accumulators, pressure compensation, load sensing, energy management and system efficiency.
Requisites: M E 363, CIV ENGR 310, CBE 320, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

BSE/M E 475 – ENGINEERING PRINCIPLES OF AGRICULTURAL MACHINERY
3 credits.

Engineering design principles of machines for the production, processing and handling of crops for food, fuel, bio-mass and fiber. Environmental and biological factors that influence machine design and operation. Economic and capacity analysis of machines and systems.
Requisites: Declared in Biological Systems Engineering or Mechanical Engineering and (M E 240, E M A 202, PHYSICS 201, 207, or 247), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

BSE/M E 476 – ENGINEERING PRINCIPLES OF OFF-ROAD VEHICLES
3 credits.

Engineering design principles of heavy-duty vehicles intended for off-road use: fuels, engine cycles, engine principles and construction, clutches, mechanical and hydrostatic transmissions, final drives, traction systems, traction modeling, dynamic behavior, suspension systems and braking.
Requisites: (M E 361 or concurrent enrollment), (M E 240, E M A 202, PHYSICS 201, 207, or 247), and declared in Biological Systems Engineering or Mechanical Engineering or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 508 – BIOLOGICAL SYSTEMS ENGINEERING DESIGN PRACTICUM I
2 credits.

Overview of the engineering design process including problem identification, information retrieval, specification writing, development and analysis of alternative solutions, selection methodology, product safety, standardization, scheduling and cost estimating. Develop design project proposals for real-world design problems.
Requisites: Declared in Biological Systems Engineering BS
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 509 – BIOLOGICAL SYSTEMS ENGINEERING DESIGN PRACTICUM II
3 credits.

Individual or team work on a biological systems engineering design project: problem identification, information retrieval, specification writing, development and analysis of alternative solutions, selection methodology.
Requisites: Senior standing and BSE 508
Repeatable for Credit: No
Last Taught: Fall 2022

BSE 571 – SMALL WATERSHED ENGINEERING
3 credits.

Application of engineering principles to small, ungauged watershed analysis. Application of hydrologic and sedimentologic principles to upland watersheds for run-off and sediment control.
Requisites: MATH 222 or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 681 – SENIOR HONORS THESIS
2-4 credits.

Individual study for undergraduate students in an Honors program completing a thesis in the area of Biological Systems Engineering, as arranged with a faculty member.
Requisites: Consent of instructor
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions

BSE 682 – SENIOR HONORS THESIS
2-4 credits.

Second semester of individual study for undergraduate students in an Honors program completing a thesis in the area of Biological Systems Engineering, as arranged with a faculty member.
Requisites: Consent of instructor
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: No

BSE 691 – SENIOR THESIS
2 credits.

Individual study for undergraduate students completing a thesis in the area of Biological Systems Engineering, as arranged with a faculty member.
Requisites: Consent of instructor
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2017

BSE 692 – SENIOR THESIS
2 credits.

Second semester of individual study for undergraduate students completing a thesis in the area of Biological Systems Engineering, as arranged with a faculty member.
Requisites: Consent of instructor
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2018

BSE 699 – SPECIAL PROBLEMS
1-4 credits.

Individual advanced work in an area of Biological Systems Engineering under the direct guidance of a faculty member.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2022

BSE 799 – PRACTICUM IN AGRICULTURAL ENGINEERING TEACHING
1-3 credits.

Hands-on teaching experience through working with a course instructor to improve pedagogical understanding. Guidance will be provided on such aspects as course planning, delivery, student supervision, and evaluation, etc.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

BSE 875 – SPECIAL TOPICS
1-4 credits.

Specialized subject matter of current interest to graduate students.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023

BSE 900 – SEMINAR
1 credit.

Provides an overview of research-related activities and resources available to graduate students in the department, college, and on campus. Includes library resources, statistical consulting, professional development, research proposal development, thesis writing, technical presentation, etc.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2022

BSE 901 – GRADUATE RESEARCH SEMINAR
1 credit.

Presentation, evaluation, and discussion of Biological Systems Engineering graduate student thesis and non-thesis research.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, for 10 number of completions
Last Taught: Spring 2023

BSE 990 – RESEARCH
1-12 credits.

Independent laboratory research in preparation of a graduate thesis under supervision of a faculty member
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2023

BSE 999 – SPECIAL PROBLEMS
1-3 credits.

In-depth study of a research or design and development problem under the supervision of a faculty member.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023