College of Engineering

Biological Systems Engineering

Overview
Biological systems engineers develop the techniques and processes to work with living systems, including microbes, plants and animals. They provide input to produce and process food, fiber, energy, chemical feedstocks and pharmaceuticals. They also emphasize efficient use of soil and water resources and environmental protection to improve water quality, control air pollution and clean up contaminated soil.

Kansas State University is the only university in Kansas that offers a biological systems engineering degree program. It is a versatile program that offers machinery, environmental and biological engineering programs.

Professional options

Careers
Biological systems engineers apply engineering, physical and biological principles to living systems in a diverse world of opportunities. They design machines and structures; manage natural resources such as soil, water, crops and forests; analyze and design ways to maintain healthy environments for humans and animals; process food, feed, fiber and waste products; and develop efficient applications of computers and automatic controls for agricultural operations and processes.

Alumni
Many businesses and industries value the knowledge and experience of a biological systems engineer. As a result, students graduating from K-State have found careers suited to their interests and education in Kansas and other states. The following are some positions held by recent graduates:

- Environmental engineer with local, national and international consulting firms.
- Application engineer for an off-road equipment manufacturer.
- Design and test engineer for a Kansas manufacturer of food processing machinery.
- Environmental engineer with major energy production corporations.
- Design and test engineer with an agricultural machinery company.
- Medical school, veterinary medical school and law school students.
- Design and application engineer for a manufacturer of air handling and pollution control equipment.
- Design engineer for an irrigation equipment manufacturing company.
- Natural resources and environmental engineer for numerous government agencies, local and federal.
- Design engineer for a manufacturer of agricultural chemical application equipment.
- Field and research engineer for an oil field service company.
- Water supply development engineer for a consulting firm.
- Design engineer for a major food processing company.
- International consultant working in agricultural development.
- Project engineer for a Kansas livestock and environmental control equipment manufacturer.
- Sales engineer/technical support for a machinery company.
- University faculty member in teaching, research and extension (with advanced degrees).

Points of pride

K-State's biological systems engineering students have won more than 150 Top 3 placements in international and national student design competitions dating back to 1977. Recruiters look for these types of experiences when hiring graduates.

Academics

The Department of Biological and Agricultural Engineering offers Bachelor of Science and graduate degrees.

In the undergraduate program, you will gain an understanding of basic engineering principles, a knowledge of biological sciences and the ability to develop new concepts and methods. Due to the diversity of biological systems engineering, three curriculum options are available: a machinery engineering option, an environmental engineering option and a biological engineering option.

Degree options

Machinery systems option
Many biological systems engineers design, test and evaluate the machines used in agriculture, construction and related off-highway industries. The machinery systems option provides graduates with the analytical tools needed to develop machines that reduce the cost of production for both traditional and new crops, while operating within environmental and energy constraints. This option includes courses that emphasize mechanical design as well as the interaction of machines with soil and plant materials. Related technologies such as fluid power, instrumentation and electronic controls also are included in this option.

Environmental option
Biological systems engineers work at the interface between biology and engineering. They must be knowledgeable in both disciplines. Applications in the environmental option include water quality studies of lakes, rivers and groundwater; soil and water conservation; irrigation and drainage system design and management; waste treatment; management of air quality inside buildings and outside; remediation of land damaged by construction, mining and other uses.

The environmental option focuses on the design and management of systems that use or affect natural resources. Nonpoint pollution issues have long been a component of agricultural engineering programs. Soil conservation programs began in the 1930s, long before the environmental movement began. Point and nonpoint pollution sources still impact the environment, requiring biological systems engineering expertise to develop solutions to those problems. This option is distinct from but interfaces with the environmental option in civil engineering.

Secondary major in natural resources and environmental sciences
Students enrolled in biological systems engineering, regardless of option, may participate in the natural resources and environmental sciences secondary major. Courses used for the secondary major also may be used for completing regular graduation requirements. Details are found in the natural resources and environmental sciences section of the online catalog at catalog.k-state.edu.

k-state.edu/admissions/academics
Biological option

Biological systems range in size from cells to complex groups of living organisms. Biological engineers work with these systems in areas that include biomaterials, bioinstrumentation, biological systems modeling, bioremediation, food and fiber processing, and energy from biological products. The biological option fulfills the requirements for a Bachelor of Science in biological systems engineering while providing students with the flexibility to receive a strong biological emphasis in their engineering program. Course selections also provide students with the option of a biology minor or they can opt to meet the requirements for a premedical or pre-veterinary program. Graduates in this program can pursue careers and/or additional studies in fields such as environmental engineering, biological systems engineering, biomedical engineering, food process engineering, medicine, natural resources and related areas.

Integrated B.S.-M.S. degree

A five-year integrated program leading to a bachelor’s degree in some engineering fields at the end of four years and a Master of Science degree at the end of five years is available for undergraduate students.

Students who have completed their sophomore year and have outstanding scholastic records are invited to join the program. Each student, in consultation with a faculty advisor, will plan an individualized program of study that meets requirements for the Bachelor of Science and Master of Science degrees. Features of the program include integrated planning, participation in research as an undergraduate and enrollment in graduate-level courses in the students’ senior year. Students participating in the program will be considered for financial assistance in the form of scholarships, fellowships, research assistantships and part-time work.

Architectural, biological and agricultural, and industrial and manufacturing systems engineering departments offer formal programs in which the Bachelor of Science degrees are completed during the same semester.

Agricultural technology management

The description and curriculum outline are listed in the College of Agriculture section of the online catalog.

Accreditation

The program is one of a small number of programs accredited by the Engineering Accreditation Commission of ABET, abet.org.

Preparation

Students are encouraged to take a college preparatory program in high school. Because the ability to communicate effectively is essential to engineers, it is important that you take courses in English and speech. High school courses in physics, chemistry and biology are highly recommended. Mathematics preparation should include two units of algebra, one unit of geometry, one-half unit of trigonometry and calculus if available.

Admission

Applications for admission are accepted up to 15 months before the first day of class each semester. Apply for admission and fill out the university scholarship application at k-state.edu/sfa/scholarships.

Financial assistance

The priority deadline for incoming freshmen to submit the K-State scholarship application is Nov. 1, or Feb. 1 for transfer students. Students should submit their Free Application for Federal Student Aid by March 1. For additional details, visit k-state.edu/sfa.

Activities

Clubs

All students are encouraged to join the student branch of the American Society of Agricultural and Biological Engineers. This organization promotes academic involvement and provides an enjoyable source of learning and student interaction outside the classroom. The club hosts field trips, faculty/student picnics, displays at K-State’s All-University Open House, club parties and other events. Student design teams have an outstanding record of success at regional and national design competitions sponsored by ASABE.

Suggested course work

A Bachelor of Science in biological systems engineering requires 127 credit-hours. The description and curriculum outline are listed in the College of Engineering section of the online catalog.