



# DISCOVER

University of Kentucky • College of Agriculture

## Biosystems and Agricultural Engineering

**UK**

Bachelor of Science in  
Agricultural Engineering

Effective: July 1, 1998

*Options:*

- Bioenvironmental Engineering, ■ Food and Bioprocess Engineering,
- Machine Systems Automation Engineering, ■ Thermal Environmental Engineering, ■ Pre-Biomedical Engineering, and

Biosystems and Agricultural Engineering provides an essential link between the biological sciences and the engineering profession. This linkage is necessary for the development of food and fiber production and processing systems which preserve our natural resource base. Students enrolling in the biosystems and agricultural engineering program have the latitude to pursue one of six areas of specialization.

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**Bioenvironmental Engineering**— prepares engineers to work in the area of natural resource conservation and environmental quality. Students selecting this option will study topics which include: surface water hydrology, groundwater hydrology, sediment transport, water quality, chemical fate and transport, waste management, reclamation of disturbed lands, site remediation, irrigation and drainage.

**Food and Bioprocess Engineering**— involves the development of equipment and methodology for efficient and ecologically sound production and processing of biological commodities and manufacture of food products.

Students selecting this option will receive extensive training in the areas of bioprocessing, heat and mass transfer, chemical transport processes, process engineering, process control, storage of biological products and materials handling.

**Machine Systems Automation Engineering**— prepares engineers to conceive and design: power units; tillage, planting and harvesting systems; materials handling equipment; and processing equipment. Production and processing of biological products relies heavily on the use of automated machinery. Students selecting this option will study: system dynamics, automated controls, machine design, kinematics, fluid power, soil dynamics, plant-machine interactions, and digital electronics.

**Thermal Environmental Engineering**— involves the development and design of heating, cooling and ventilation systems to control indoor environments. Environmental control is an essential component of total confinement animal housing, greenhouse production, aquaculture, and human housing. Students selecting this option will study: heat and mass transfer; physics of plant and animal environments; electronics and computer control; meteorology; heating, ventilation and air conditioning design, structural design, and air quality.

**Pre-Biomedical Engineering**— involves the application of engineering to human health care delivery, medical safety, biomaterials, tissue mechanics, clinical engineering, prosthetic devices and biosensors. Biosystems and Agricultural Engineering and the Center for Biomedical Engineering together have developed a pre-biomedical engineering

option. Undergraduates who complete this option and are in good academic standing are encouraged to apply for the Biomedical Engineering graduate program at UK.

**Pre-Veterinary Medicine**— the department has an approved pre-veterinary medicine curriculum whereby students may obtain a B.S. in Agricultural Engineering and simultaneously fulfill requirements for admission to veterinary school.

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*Students have the option to develop expertise in one of the above areas by selecting 21 credit hours of technical electives. These electives are selected in consultation with an advisor during the third and fourth years of study.*

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## Career Opportunities

Engineers completing this program of study find employment in industries which manufacture equipment for production and processing of biological products. Opportunities include placement with manufacturers of agricultural machinery; grain drying and handling equipment; heating, ventilation and refrigeration equipment; food processing equipment; livestock equipment and housing; and greenhouse structures and equipment.

Recent graduates have also found employment within the food processing, pharmaceutical and biotechnology industries in the area of production and quality control. Employment opportunities exist for bioenvironmental engineers with state and federal regulatory agencies, and in engineering consulting firms. Program graduates also find this curriculum attractive as preparation for graduate and advanced professional degree programs.

## Graduation Requirements

To earn a Bachelor of Science in Agricultural Engineering students must complete 134 credit hours, be enrolled in the College of Engineering, and be admitted to Engineering Standing by achieving a grade point average (GPA) of 2.25 (computed using grades from the most recent attempt at each course) in the core courses and an overall cumulative GPA of 2.25. The core courses consist of:

ENG 101/102— Writing I and II

MA 113—Calculus I

MA 114—Calculus II

MA 213—Calculus III

MA 214—Calculus IV

PHY 231/232—General University Physics I and II

PHY 241/242—General University Physics

Laboratory I and II

CHE 105—General College Chemistry I

CHE 107—General College Chemistry II

EM 221—Statics

AEN 202—BiosystemsEngineering Problems

BIO 150—Principles of Biology I

BIO 152—Principles of Biology II

CS 221—First Course in Computer Science for Engineers

An overall grade point average of 2.0 (on a 4.0 point scale) is required for graduation. In addition to the University Studies Program, students must satisfy departmental and Accreditation Board for Engineering and Technology (ABET) requirements.

## University Studies Program (USP)

### Requirements: 18-21 hours

In addition to College of Engineering requirements, students must meet the following University Studies Program requirements:

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### I. Basic Skills Requirements

#### A. Mathematics

Students enrolled in engineering fulfill this requirement by taking MA 113 Calculus I, a required course in the College of Engineering.

#### B. Foreign Language

*Completed by one of the following:*

1. Two years of the same foreign language in high school, or
2. Six credit hours from an approved USP foreign language sequence.

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### II. Inference and Communication Skills

#### A. Inference

Students enrolled in engineering fulfill this requirement by taking MA 113 Calculus I, a required course in the College of Engineering.

#### B. University Writing Requirement

ENG 101/102 Writing I and II are required for all engineering students. A score of 29 or above on the English component of the ACT test and ENG 105 Writing: An Accelerated Course, can also be used to meet this requirement. Students can also fulfill this requirement through enrollment in the University Honors Program.

#### C. Oral Communications

Students enrolled in the Agricultural Engineering curriculum meet this requirement by taking a combination of:

COM 199—Presentational Communication Skills

AEN 400—Senior Seminar in Agricultural Engineering

AEN 401— Design in Agricultural Engineering

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### III. Disciplinary Requirements

#### A. Natural Sciences

Students enrolled in engineering fulfill this requirement by taking PHY 231 General University Physics and PHY 232 General University Physics, both required courses in the College of Engineering.

#### B. Social Sciences

Six hours from an approved list.

#### C. Humanities

Six hours from an approved sequence.

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### IV. Cross Disciplinary

Six hours from an approved list.

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### V. Cross-Cultural

Three hours from the approved list.

## Biosystems and Agricultural Engineering Core Course Requirements: 37 hours

ENG 101—Writing I .....	3
ENG 102—Writing II .....	3
CHE 105—General College Chemistry I .....	3
CHE 107—General College Chemistry II .....	3
MA 113—Calculus I .....	4
MA 114—Calculus II .....	4
MA 213—Calculus III .....	4
MA 214—Calculus IV .....	3
PHY 231—General University Physics .....	4
PHY 241—General University Physics Laboratory .....	1
PHY 232—General University Physics .....	4
PHY 242—General University Physics Laboratory .....	1
AEN 202—Biosystems Engineering Problems .....	2
EM 221— Statics .....	3
CS 221—First Course in Computer Science for Engineers .....	2
BIO 150—Principles of Biology I .....	3
BIO 152—Principles of Biology II .....	3

Students pursuing a degree in Agricultural Engineering will enroll in the College of Engineering as a Pre-Engineering student. Upon completion of the core courses students may apply for admission to Engineering Standing.

Admission is granted to students completing the core courses with a minimum grade-point average of 2.25 (computed using grades from the most recent attempt at each course). No student will be admitted for Engineering

Standing if either the core or cumulative grade point averages fall below 2.25.

## Departmental Requirements: 79 hours

### A. General Requirements (55 credits)

AEN 102—Introduction to Biosystems Engineering .....	1
AEN 202—Biosystems Engineering Problems .....	2
AEN 301—Microelectronic Applications in Biosystems Engineering .....	2
AEN 302—Analytical and Numerical Methods for Biosystems .....	3
AEN 308—Engineering Properties of Biological Materials .....	3
AEN 343—Fluid Mechanics of Biosystems .....	3
AEN 400—Senior Seminar in Agricultural Engineering .....	1
AEN 401—Design in Agricultural Engineering .....	4
AEN 402—Dynamics of Biological Systems .....	3
AEN 407—Economic Analysis of Biosystems .....	2
BIO 208—Principles of Microbiology .....	3
EE 307—Circuit Analysis with Applications .....	4
EM 302—Mechanics of Deformable Solids .....	3
EM 303—Deformable Solids Laboratory .....	1
ME 105—Basic Engineering Graphics .....	2
ME 220—Engineering Thermodynamics I .....	3
ME 330—Fluid Mechanics .....	3

### B. Technical Electives (21 credits)

Technical electives, composed mainly of engineering coursework, enable students to specialize in one of the six concentrated areas. Select these electives in consultation with an advisor. They must contain at least 11 hours of courses classified as engineering sciences and 4 hours as engineering design in accordance with ABET criteria.

### C. Supportive Elective (3 credits)

Select supportive electives from any University course offerings, excluding more elementary courses such as pre-calculus or introductory physics.

## Suggested Schedule

If you enroll at UK during your first semester, you may follow this suggested schedule. **Use this schedule only as a guide**, since schedules will vary if: you transfer to UK, receive credit by examination, credit via advanced college placement programs, or you do not start in the fall semester. Your faculty advisor will assist you in course selection and career planning.

This plan is for students who complete two years of the same foreign language requirement in high school. All other students must complete six hours of foreign language from an approved sequence at the University.

## First Year

### Fall Semester

AEN 102—Introduction to Biosystems Engineering .....	1
CHE 105—General College Chemistry I .....	3
ENG 101—Writing I .....	3
MA 113—Calculus I .....	4
ME 105—Basic Engineering Graphics .....	2
GEN 101—The Economics of Food and Agriculture .....	3

### Spring Semester

CHE 107—General College Chemistry II .....	3
CS 221—First Course in Computer Science for Engineers .....	2
ENG 102—Writing II .....	3
MA 114—Calculus II .....	4
PHY 231—General University Physics .....	4
PHY 241—General University Physics Laboratory .....	1

## Second Year

### Fall Semester

AEN 202—Biosystems Engineering Problems .....	2
BIO 150—Principles of Biology I .....	3
EM 221—Statics .....	3
MA 213—Calculus III .....	4
PHY 232—General University Physics .....	4
PHY 242—General University Physics Laboratory .....	1

### Spring Semester

BIO 152—Principles of Biology II .....	3
COM 199—Presentational Communication Skills .....	1
EM 302—Mechanics of Deformable Solids .....	3
EM 303—Deformable Solids Laboratory .....	1
MA 214—Calculus IV .....	3
ME 220—Engineering Thermodynamics I .....	3
GEN 102—Dynamics of Rural Social Life .....	3

## Third Year

### Fall Semester

AEN 302—Analytical and Numerical Methods for Biosystems .....	3
AEN 308—Engineering Properties of Biological Materials .....	3
EE 307—Circuit Analysis with Applications .....	4
BIO 208—Microbiology .....	3
ME 330—Fluid Mechanics .....	3
USP .....	3

### Spring Semester

AEN 301—Microelectronic Applications in Biosystems Engineering .....	2
AEN 343—Fluid Mechanics of Biosystems .....	3
AEN 402—Dynamics of Biological Systems .....	3
Technical Electives .....	6
USP .....	3

## Fourth Year

### Fall Semester

AEN 400—Senior Seminar in Agricultural Engineering .....	1
AEN 401—Design in Agricultural Engineering .....	4
AEN 407—Economic Analysis of Biosystems .....	2
Technical Electives .....	6
USP .....	3

### Spring Semester

Technical Electives .....	9
Supportive Elective .....	3
USP .....	3

## Technical and Supportive Elective Programs

The following suggested technical elective programs are representative of those required in the various options. Each student must, in consultation with her or his academic advisor, develop a list of electives to meet her or his specific needs and to satisfy the requirements of the Agricultural Engineering curriculum.

Students selecting the Food and Bioprocess Engineering option will need to take 16 hours of biology, chemistry, and food science beyond first-year courses to meet the American Society of Agricultural Engineers requirements for a Food Engineering program. Most of these courses overlap other requirements of the curriculum, but in general these students will need to take from 4 to 9 hours of coursework beyond that listed for the basic Agricultural Engineering curriculum. Students interested in this option should contact a departmental advisor for guidance.

## Bioenvironmental Engineering Option

### Technical Electives

AEN 435G—Waste Management for Biosystems
AEN 438G—Fundamentals of Groundwater Hydrology
AEN 536—Fluvial Hydraulics
AEN 537—Irrigation and Drainage Engineering
CE 441—Fluid Mechanics II
CE 461G—Hydrology
CE 471G—Soil Mechanics

### Supportive Elective

PLS 366—Fundamentals of Soil Science
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## **Food and Bioprocess Engineering Option**

### **Technical Electives**

AEN 435G—Waste Management for Biosystems  
AEN 549—Food and Bioprocess Engineering  
CME 200—Process Principles  
CME 425—Heat and Mass Transfer  
CME 462—Process Control  
CHE 236—Survey of Organic Chemistry  
FSC 434G—Food Chemistry

### **Supportive Elective**

CHE 115—General Chemistry Laboratory

## **Machine Systems Automation Engineering Option**

### **Technical Electives**

AEN 417G—Design of Machine Systems  
AEN 513—Soil Dynamics in Tillage and Traction  
AEN 515—Fluid Power Systems  
EM 313—Dynamics  
ME 406—Computer-Aided Graphics and Design  
ME 501—Mechanical Design with Finite Element Methods  
ME 507—Design for Manufacturing

### **Supportive Elective**

PLS 366—Fundamentals of Soil Science

## **Thermal Environmental Engineering Option**

### **Technical Electives**

AEN 406G—Physics of Plant and Animal Environments  
AEN 435G—Waste Management for Biosystems  
AEN 480G—Heating, Ventilation, and Air Conditioning  
AEN 549—Food and Bioprocess Engineering  
CE 382—Structural Mechanics  
ME 321—Engineering Thermodynamics II  
ME 325—Elements of Heat Transfer

### **Supportive Elective**

CE 506—The Engineer, the Law, and the Environment

## **Pre-Biomedical Engineering Option**

### **Technical Electives**

AEN 406G—Physics of Plant and Animal Environment Systems  
AEN 435G—Waste Management for Biosystems  
AEN 480G—Heating, Ventilation, and Air Conditioning  
AEN 549—Food and Bioprocess Engineering  
BME 481G—Topics in Biomedical Engineering

BME 501—Introduction to Biomedical Engineering  
BME 530—Biomedical Instrumentation  
KHP 515—Anatomical and Mechanical Kinesiology

### **Supportive Elective**

CHE 230—Organic Chemistry I

## **Pre-Veterinary Medicine Option**

### **Technical Electives**

AEN 549—Food and Bioprocess Engineering  
BME 481G—Topics in Biomedical Engineering  
BME 501—Introduction to Biomedical Engineering  
BME 530—Biomedical Instrumentation  
CHE 230—Organic Chemistry I  
CME 599—Bioprocess Engineering  
KHP 515—Anatomical and Mechanical Kinesiology

### **Supportive Elective**

PGY 206—Physiology

### **Additional Courses**

BIO 151—Principles of Biology Laboratory I  
BIO 153—Principles of Biology Laboratory II  
CHE 115—General Chemistry Laboratory  
CHE 231—Organic Chemistry Laboratory I  
CHE 232—Organic Chemistry II  
CHE 233—Organic Chemistry Laboratory II

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## **For more information contact:**

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