

AGRICULTURAL & BIOLOGICAL ENGINEERING, PHD

for the degree of Doctor of Philosophy in Agricultural & Biological Engineering

Opportunity exists for specializing in computational science and engineering via the Computational Science & Engineering (<http://catalog.illinois.edu/graduate/engineering/concentration/computational-science-engineering/>) optional graduate concentration.

Admission Requirements

Admission to the PhD program is limited to individuals who have demonstrated exceptional ability through outstanding performance in obtaining an MS degree and/or through a high degree of technical and professional accomplishment. Candidates must also satisfy entrance requirements for the MS degree program.

All applicants whose native language is not English must submit a minimum TOEFL (<http://www.toefl.org/>) score of 88 (iBT), 230 (CBT) or 570 (PBT); or minimum International English Language Testing System (IELTS) (<http://www.ielts.org/>) academic exam scores of 6.5 overall. Applicants may be exempt from the TOEFL if certain criteria (<http://grad.illinois.edu/admissions/instructions/04c/>) are met. For those taking the TOEFL or IELTS, full admission status (<http://grad.illinois.edu/admissions/instructions/04c/>) is granted for scores greater than 102 (TOEFL iBT), 253 (TOEFL CBT), 610 (TOEFL PBT), or 7.0 (IELTS). Limited status (<http://grad.illinois.edu/admissions/instructions/04c/>) is granted for lesser scores and requires enrollment in English as a Second Language (ESL) courses (<https://linguistics.illinois.edu/testing/english-placement-test-ept/>) based on an ESL Placement Test (EPT) taken upon arrival to campus.

Financial Aid

Fellowships, supported by University, College of Agricultural, Consumer and Environmental Sciences, and The Grainger College of Engineering funds, are available on a competitive basis. A limited number of assistantships, providing both teaching and research experience, are often available on a half-time basis. Starting in Fall 2020, Grainger Engineering PhD students in their first five years of enrollment who meet the minimum eligibility requirements (<https://grainger.illinois.edu/academics/graduate/phd-funding-guarantee/>) are guaranteed a funded appointment for fall and spring that includes a full tuition waiver, a partial fee waiver, and a stipend.

All applicants, regardless of US citizenship, whose native language is not English and who wish to be considered for teaching assistantships must demonstrate spoken English language proficiency (<http://grad.illinois.edu/admissions/taengprof.htm>) by achieving a minimum score of 24 on the speaking subsection of the TOEFL iBT or 8 on the speaking subsection of the IELTS. For students who are unable to take the iBT or IELTS, a minimum score of 4CP is required on the EPI test (http://cte.illinois.edu/testing/oral_eng/epi_overview.html), offered on campus. All new teaching assistants are required to participate in the Graduate Academy for College Teaching (<https://citl.illinois.edu/citl-101/teaching-learning/grad-academy-for-college-teaching/>) conducted prior to the start of the semester.

Graduate Teaching Experience

Experience in teaching is considered a vital part of the graduate program and is required as part of the academic work of all PhD candidates in this program. For details of expectations, see the department's Graduate Handbook (<https://abe.illinois.edu/academics/graduate-degrees/>).

Department Research

Current research interests of the faculty include off-road equipment engineering (robotics and machinery automation, remote sensing and precision agriculture, machinery management systems, pesticide application technology, engines and biofuels); soil and water resources (hydrology, erosion and sediment transport, water management, wetlands, and water quality); bioenvironmental engineering (building environment and energy conservation, air quality, renewable energy, biomass to bioenergy conversion, structural analysis and facility design, building materials evaluation, environmental control and ergonomic design for plant, animal, and human housing systems and facilities); food and bioprocess engineering (engineering properties of foods, physical properties of biological products, grain drying, grain quality evaluation, dry-grind corn processing, wet and dry milling, modified bioprocesses for improved co-products, fuel and chemicals, fermentation, and transport phenomenon in biological materials); or electronic and electrical systems (biosensors and controls, energy systems, machine vision, near-infrared spectroscopy applications, bionanotechnology, microfabricated devices, bioconjugation techniques, transcriptional control, modeling life support systems, and multiscale biological processes). For more details, visit the department's research website. (<https://abe.illinois.edu/research/areas/>)

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For additional details and requirements for all degrees, please refer to the program's Graduate Degree Requirements (<https://abe.illinois.edu/graduate/>) and the Graduate College Handbook (<http://www.grad.illinois.edu/gradhandbook/>).

Entering with approved M.S./M.A. degree

Code	Title	Hours
ABE 501	Graduate Seminar: Foundations of Success	1
ABE 502	Graduate Seminar: Advanced Career Skills	1
ABE 503	Graduate Seminar: Integrity, Teaching and Research	1

ABE 501, 502, and 503 not required if taken for the ABE-MS.

One mathematics intensive course beyond differential equations (3 hour credit versions permitted) 3-4

IB 494	Theoretical Biology + Models
MATH 412	Graph Theory
MATH 413	Intro to Combinatorics
MATH 416	Abstract Linear Algebra
MATH 432	Set Theory and Topology
MATH 442	Intro Partial Diff Equations
MATH 444	Elementary Real Analysis
MATH/CS 450	Numerical Analysis
MATH 489	Dynamics & Differential Eqns
MATH 553	Partial Differential Equations
ME 462	Advanced Computer Control

ME 520	Heat Conduction	
ME 521	Convective Heat Transfer	
TAM 541	Mathematical Methods I	
TAM 542	Mathematical Methods II	
One course in statistical design and analysis (3 hour credit versions permitted)		3-4
ABE/ANSC 445	Statistical Methods	
CEE 491	Decision and Risk Analysis	
CPSC 540	Applied Statistical Methods II	
CPSC 543	Appl. Multivariate Statistics	
STAT 410	Statistics and Probability II	
STAT 420	Methods of Applied Statistics	
STAT 424	Design of Experiments	
STAT 425	Statistical Modeling I	
STAT 429	Time Series Analysis	
STAT 448	Advanced Data Analysis	
STAT 530/ CHBE 571	Bioinformatics	
STAT 542	Statistical Learning	
STAT 571	Multivariate Analysis	
One course in instrumentation and measurement (3 hour credit versions permitted)		3-6
ABE 425	Engrg Measurement Systems	
CHEM 420 & CHEM 440	Instrumental Characterization and Physical Chemistry Principles	
CEE 458	Water Resources Field Methods	
ME 461	Computer Cntrl of Mech Systems	
BIOE 414 & BIOE 415	Biomedical Instrumentation and Biomedical Instrumentation Lab	
One 500-level course (taken for at least 3 credit hours) in an area of specialization – chosen in consultation with advisor		3-5
Elective courses – chosen in consultation with advisor (subject to Other Requirements and Conditions below)		1-8
ABE 599	Thesis Research	up to 41
Total Hours		64

Other Requirements and Conditions (may overlap)

Code	Title	Hours
A maximum of 4 hours of ABE 597 (or other independent study) may be applied toward the elective course work requirement.		
Additional courses may be approved in consultation with the Director of Graduate Studies		
Teaching experience determined in consultation with advisor using guidance provided by the department's Graduate Handbook.		
The minimum program GPA is 3.0.		
Ph.D. exam and dissertation requirements:		
Preliminary exam		
Final Exam or dissertation defense		
Dissertation deposit		

Entering with approved B.S./B.A. degree (Direct PhD)

Code	Title	Hours
ABE 501	Graduate Seminar: Foundations of Success	1
ABE 502	Graduate Seminar: Advanced Career Skills	1
ABE 503	Graduate Seminar: Integrity, Teaching and Research	1
One mathematics intensive course beyond differential equations (3 hour credit versions permitted)		3-4
IB 494	Theoretical Biology + Models	
MATH 412	Graph Theory	
MATH 413	Intro to Combinatorics	
MATH 416	Abstract Linear Algebra	
MATH 432	Set Theory and Topology	
MATH 442	Intro Partial Diff Equations	
MATH 444	Elementary Real Analysis	
MATH/CS 450	Numerical Analysis	
MATH 489	Dynamics & Differential Eqns	
MATH 553	Partial Differential Equations	
ME 462	Advanced Computer Control	
ME 520	Heat Conduction	
ME 521	Convective Heat Transfer	
TAM 541	Mathematical Methods I	
TAM 542	Mathematical Methods II	
One course in statistical design and analysis (3 hour credit versions permitted)		3-4
ABE/ANSC 445	Statistical Methods	
CEE 491	Decision and Risk Analysis	
CPSC 540	Applied Statistical Methods II	
CPSC 543	Appl. Multivariate Statistics	
STAT 410	Statistics and Probability II	
STAT 420	Methods of Applied Statistics	
STAT 424	Design of Experiments	
STAT 425	Statistical Modeling I	
STAT 429	Time Series Analysis	
STAT 448	Advanced Data Analysis	
STAT 530/ CHBE 571	Bioinformatics	
STAT 542	Statistical Learning	
STAT 571	Multivariate Analysis	
One course in instrumentation and measurement (3 hour credit versions permitted)		3-6
ABE 425	Engrg Measurement Systems	
CEE 458	Water Resources Field Methods	
CHEM 420 & CHEM 440	Instrumental Characterization and Physical Chemistry Principles	
BIOE 414 & BIOE 415	Biomedical Instrumentation and Biomedical Instrumentation Lab	
ME 461	Computer Cntrl of Mech Systems	
Two 500-level courses (taken for at least 3 credit hours each) in an area of specialization – chosen in consultation with advisor		6-10

Two additional courses from any of the three categories above (mathematics intensive, statistical design and analysis, and/or instrumentation and measurement)	6-12
Elective courses – chosen in consultation with advisor (subject to Other Requirements and Conditions below)	7-20
ABE 599 Thesis Research	up to 52
Total Hours	96

Other Requirements and Conditions (may overlap)

Requirement	Description
Two 500-level courses must be formal coursework, not seminar courses, special topics or independent study.	
A maximum of 4 hours of ABE 597 (or other independent study) may be applied toward the elective course work requirement.	
Teaching experience determined in consultation with advisor using guidance provided by the department’s Graduate Handbook.	
The minimum program GPA is 3.0.	
Ph.D. exam and dissertation requirements:	
Qualifying requirements review in the 2nd year: It is required to complete all courses in math, statistics and instrumentation by the 3rd semester with a 3.0 or higher GPA.	
Preliminary exam	
Final Exam or dissertation defense	
Dissertation deposit	

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Student learning outcomes are based on educational outcomes suggested by the Accreditation Board for Engineering and Technology (ABET) and the objectives of the program:

1. An ability to apply knowledge of mathematics, science, and engineering;
2. An ability to design and conduct experiments, as well as to analyze and interpret data;
3. An ability to design 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;
4. An ability to function in multidisciplinary teams;
5. An ability to identify, formulate, and solve engineering problems;
6. An understanding of professional and ethical responsibility;
7. An ability to communicate effectively;

8. The broad education necessary to understand 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 life-long learning;
10. A knowledge of contemporary issues;
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
12. Conduct independent research with expertise in research design, methods, and analysis;
13. Function effectively in leadership roles in their professional careers and activities in professional societies.
14. For Ph.D. graduates entering academia, function effectively as instructors with presentation skills, e.g., teaching skills (in addition to 1-13).

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Department of Agricultural & Biological Engineering

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 Director of Graduate Studies: Xinlei Wang
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College of Agricultural, Consumer & Environmental Sciences (ACES)

College of Agricultural, Consumer & Environmental Sciences website (<http://catalog.illinois.edu/schools/aces/>)

Grainger College of Engineering

Grainger College of Engineering website (<https://grainger.illinois.edu/>)

Admissions

Agricultural & Biological Engineering Admissions & Requirements (<https://abe.illinois.edu/apply/#graduate>)
 Graduate College Admissions & Requirements (<https://grad.illinois.edu/admissions/apply/>)