

GRADUATE HANDBOOK

Agricultural and Biological Engineering (ABENG)

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This document is available at: <https://abe.psu.edu/graduateprograms/abe/abe-graduate-handbook>

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INTRODUCTION

This graduate handbook was developed to inform graduate students and faculty in the Agricultural and Biological Engineering Department at Penn State of the policies and guidelines applicable to the department's Agricultural and Biological Engineering (ABENG) graduate degree. The requirements specified in the handbook are intended to make the graduate student's degree program beneficial to both the student and the department. Some other useful publications are listed in the table below. Students and faculty are encouraged to suggest improvements for this handbook to the Graduate Program Coordinator.

Penn State's *Graduate Degree Programs Bulletin* (hereafter referred to as "Graduate Bulletin") contains additional, important information. This handbook is intended to supplement—rather than duplicate—the graduate bulletin. The graduate bulletin may be considered the authority, except where more stringent requirements are imposed by the department. **The student is expected to become familiar with the requirements as specified in both this handbook and the graduate bulletin.** The student is advised to obtain and keep versions of the bulletin and this handbook that are in effect when the student's degree program begins; requirements specified in both of these documents form a "contract" for graduate study between the University and the student.

The department is committed to providing a stimulating, conducive educational environment for all. Please inform the Department Head immediately of any barriers—experienced or perceived—that create problems or limitations in educational opportunities in the department.

SOURCES OF GRADUATE INFORMATION

<u>Title</u>	<u>Availability*</u>	<u>Comments</u>
ABENG Graduate Handbook	https://abe.psu.edu/graduateprograms/abe/abe-graduate-handbook Updated periodically.	ABENG degree requirements - additional to the general degree requirements
Graduate Degree Programs Bulletin	http://bulletins.psu.edu/bulletins/whitebook/	General degree requirements for all graduate programs
Graduate Course Descriptions	http://bulletins.psu.edu/graduate/courses/	Graduate degree university course descriptions
Schedule of Courses	https://public.lionpath.psu.edu/psp/CSPRD/EMPLOYEE/H RMS/c/COMMUNITY_ACCESS.CLASS_SEARCH.GBL?pslnkid=PE_S201801181044562576711220	Semester courses available
Thesis and Dissertation Information	http://www.gradsch.psu.edu/current/thesis.html	Office of Theses and Dissertations forms and information
Policies and Rules	http://studentaffairs.psu.edu/conduct/	Student Affairs, The Office of Student Conduct information
New Student Orientation	http://orientation.psu.edu/	University Park new student orientation information

*Some of these publications are also available in printed form from the Penn State Bookstore located in the HUB, or from the Graduate School, 114 Kern Building.

ABENG Degrees

Master of Science (M.S.)

Admission Requirements

Completion of an undergraduate engineering degree including coursework equivalent to the core courses shown below is required for admission to the M.S. ABENG degree program. Students need at least a 3.00 (4.00 base) junior-senior average to be considered for admission.

A student with an undergraduate degree in a non-engineering field may be admitted on a conditional or provisional basis. The student will remain on a provisional basis until completing the engineering courses listed below with a minimum grade point average of 2.75. These preparatory courses or their equivalents may be completed at Penn State or elsewhere but cannot be used to satisfy any of the graduate degree course requirements. But, courses fulfilling the graduate degree requirements may be taken concurrently. The required preparatory courses are:

1. Statics: E MCH 211
2. Dynamics: E MCH 212
3. Strength of Materials: E MCH 213
4. Thermodynamics: ME 300
5. Fluid Mechanics: CE 360 or ME 320
6. Ordinary and Partial Differential Equations: MATH 251
7. B E¹ basics (3 credits): B E 30X that serves as the prerequisite to the selected B E design 46x or 47x course.
8. B E design (3 credits): B E 46X or 47X
9. Any prerequisite courses required to take the above courses, especially including mathematics, chemistry, and physics.

Graduate Record Examination (GRE). All students **must** submit GRE general aptitude test scores to be considered for admission.

To qualify for admission, all international applicants must take and submit scores for the TOEFL (*Test of English as a Foreign Language*) or the IELTS (*International English Language Testing System*), with the exceptions noted below. The minimum acceptable score for the TOEFL is 550 for the paper-based test, 213 for the computer-based test, or a total score of 80 with a 19 on the speaking section for the internet-based test. The minimum composite score for the IELTS is 6.5.

International applicants are exempt from the TOEFL/IELTS requirement who have received a baccalaureate or a master's degree from a college/university/institution in any of the following: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States, and Wales.

¹ BE = Biological Engineering

Advisory Committee

An initial Advisor will be assigned to each entering graduate student by the Department Head, in consultation with the Graduate Program Coordinator for their indicated research emphasis area. Whenever practical, research interests of the student and assigned Advisor will be compatible. New graduate students are highly encouraged to visit with various faculty members concerning opportunities for thesis research activities. After the student has decided on the preferred research area, he/she should inform the Graduate Program Coordinator or Department Head—by the middle of the first semester of study—of the preferred faculty member to serve as permanent Advisor. EACH STUDENT SHOULD SCHEDULE AT LEAST A ONE-HOUR MEETING EACH WEEK WITH THE ADVISOR TO ENSURE ADEQUATE COMMUNICATIONS.

An M.S. Advisory Committee must consist of at least three faculty, all of whom are members of the Graduate Faculty. One member of the committee must be from outside the department in a field related to the thesis problem. If a student selects a minor, then one member of the committee must be a faculty member of the minor department. See also “Advisory Committee Responsibilities” section.

Course Requirements

Each M.S. program of study must meet the following requirements:

	<u>Credits</u>
• ABE 500 Research Methods (required during first Fall Semester)	3
• ABE 5XX or 8XX course (excluding ABE 500, 590, 594-596)	3
• Agricultural/biological sciences	3
• Statistics or mathematical analysis	3
• Additional 4XX, 5XX, or 8XX-level courses	12
• ABE 600 Thesis Research	<u>6</u>
	30

A total of at least 12 credits must be from 5XX and/or 8XX courses and all courses used to meet course requirements above must be 4XX, 5XX, or 8XX. In addition to the above listed course work requirements, every graduate student must fulfill the Scholarship and Research Integrity (SARI) requirement. SARI requirement consists of two parts: 1) completion of ABE 500 with a grade of B or better and 2) completion of online training program at: <http://www.research.psu.edu/training/sari>- Responsible Conduct of Research (RCR) for Engineers. The online SARI requirement must be completed within one year from date of enrollment in the program of study. A copy of the completion certificate of the online SARI training program should be given to the Graduate Program Coordinator. This will be placed in the student’s department folder.

A minimum grade point average of 3.00 is required for graduation. Only grades of C or better are accepted for graduate credit. All courses must be approved by the Advisory Committee as having significance and value for the degree program. All requirements for M.S. degree, whether satisfied on this campus or elsewhere, must be met within eight years from the first semester of graduate study.

The academic and professional requirements for agricultural and biological engineers are closely related to the agricultural and biological sciences as well as engineering. This makes ABENG unique from other fields of engineering. To promote and fulfill this uniqueness, continuation of courses in the agricultural and biological sciences at the graduate level is encouraged.

Final Oral Examination

Each M.S. degree student must complete a Final Oral Examination, consisting primarily of defense of the thesis research activity. However, the examination may cover the entire field of Agricultural and Biological Engineering. The Graduate Program Coordinator must be notified of the exam date, time, and location at least two weeks prior to the scheduled date. The Graduate Program Coordinator will inform the committee members, via memo, of the date, time and location and include the M.S. thesis final exam report form. The completed thesis final exam form should be returned to the Graduate Program Coordinator for placing in the student's department folder. Otherwise, the guidelines for this examination are basically the same as the guidelines for the Ph.D. Final Oral Examination; see that section for further information.

Schedule for M.S. Requirements

Many of the M.S. degree requirements are listed in approximate chronological order on the following page. It is the student's responsibility to ensure that these and all other requirements are met in a timely manner. It is expected that M.S. students should complete the degree in about 17 months and departmental assistantship support (if awarded) to a M.S. student is granted for no more than 17 months.

SUMMARY SCHEDULE FOR M.S. DEGREE

Requirement	Suggested Completion Dates
Recommend permanent Advisor.	Middle of first semester.
Submit to Advisor a list of courses to comprise graduate plan of study.	End of first semester.
Recommend to Graduate Coordinator faculty members to serve on Advisory Committee.	End of first semester.
Transfer credit from undergraduate or post-baccalaureate program, if appropriate.	End of first semester.
Prepare thesis research project proposal for Advisor.	End of first semester.
Complete semi-annual progress report form.	Each January and July.
Submit plan of study and thesis project proposal to Advisory Committee for approval (copy to Graduate Program Coordinator).	Beginning of second semester.
SARI Online Requirement, http://www.research.psu.edu/training/sari	Complete the online requirement within one year from the date of enrollment in the program of study. Give a copy of the completion certificate to the Graduate Program Coordinator.
Apply to graduate in LionPATH.	Beginning of semester or summer session in which degree is expected.
Pay thesis fee through the Graduate School Payment Portal at https://secure.gradsch.psu.edu/paymentportal/ .	Beginning of semester or summer session in which degree is expected.
Submit draft thesis to Advisor.	Early in last semester.
Schedule final oral examination through the Graduate Program Coordinator and distribute copies of thesis to Advisory Committee members.	Distribute thesis only AFTER the thesis has been approved by Advisor.
Present departmental seminar based on results of thesis research; schedule through the Seminar Chair	After Final Oral Exam if practical; otherwise, as close to it as is practical.
Submit original copy of thesis to Department Head for signature, then to Graduate School.	After Advisory Committee signs and prior to Graduate School deadline.
Departure meeting with Department Head.	Two weeks prior to departure.
Prepare manuscript(s) for publication based on thesis research activity.	Prior to departure.
Disassemble research apparatus and clean as necessary; return equipment and supplies to designated areas. Clean office, desk and file space; empty all drawers and shelves and remove posters.	Prior to departure.
Return departmental keys, books, software, supplies, etc. to Administrative Assistant.	Prior to departure.
Provide an electronic copy of thesis to Advisor.	Prior to departure.

Doctor of Philosophy (Ph.D.)

Admissions Requirements

The requirement for acceptance to graduate study toward a Ph.D. degree in ABENG is an M.S. degree with research thesis in an engineering or science discipline with a B.S. degree from an engineering program including the core courses shown below. Outstanding students interested in direct admission from a B.S. engineering program to the Ph.D. Program should contact the Graduate Program Coordinator. Direct admission will be based on critical evaluation of the student's potential to conduct publishable research, academic record, results of standardized tests, statement of purpose, and reference letters. Students who apply directly to the Ph.D. program but are not qualified will be considered for admission into the M.S. program.

A student with an undergraduate degree in a non-engineering field may be admitted on a conditional or provisional basis. The student will remain on a provisional basis until completing the engineering courses listed below with a minimum grade point average of 2.75. These preparatory courses or their equivalents may be completed at Penn State or elsewhere but cannot be used to satisfy any of the graduate degree course requirements. But, courses fulfilling the graduate degree requirements may be taken concurrently. The required preparatory courses are:

1. Statics: E MCH 211
2. Dynamics: E MCH 212
3. Strength of Materials: E MCH 213
4. Thermodynamics: ME 300
5. Fluid Mechanics: CE 360 or ME 320
6. Ordinary and Partial Differential Equations: MATH 251
7. B E² basics (3 credits): B E 30X that serves as the prerequisite to the selected B E design 46x or 47x course
8. B E design (3 credits): B E 46X or 47X
9. Any prerequisite courses required to take the above courses, especially including mathematics, chemistry, and physics

Graduate Record Examination (GRE). All students **must** submit GRE general aptitude test scores to be considered for admission.

To qualify for admission, all international applicants must take and submit scores for the TOEFL (*Test of English as a Foreign Language*) or the IELTS (*International English Language Testing System*), with the exceptions noted below. The minimum acceptable score for the TOEFL is 550 for the paper-based test, 213 for the computer-based test, or a total score of 80 with a 19 on the speaking section for the internet-based test. The minimum composite score for the IELTS is 6.5.

International applicants are exempt from the TOEFL/IELTS requirement who have received a baccalaureate or a master's degree from a college/university/institution in any of the following: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States, and Wales.

² BE = Biological Engineering

Dissertation committee

An initial Advisor will be assigned to each entering graduate student by the Department Head, in consultation with the ABENG Graduate Program Coordinator. Whenever practical, the research interests of the student and assigned Advisor will be compatible. New graduate students are highly encouraged to visit with various faculty members concerning opportunities for thesis research activities. After the student has decided on the preferred research area, he/she should inform the Graduate Program Coordinator and Department Head—by the middle of the first semester of study—of the preferred faculty member to serve as permanent Advisor. EACH STUDENT SHOULD SCHEDULE AT LEAST A ONE-HOUR MEETING EACH WEEK WITH THE ADVISOR TO ENSURE ADEQUATE COMMUNICATIONS.

A Ph.D. Dissertation committee must consist of four or more members of the Graduate Faculty and:

- The chairperson and at least one other member must be from ABENG.
- At least one member must be from a department other than ABE.
- At least two members must have doctoral degrees in engineering or be licensed professional engineers.
- At least one member must represent any minor department(s) if the student selects a minor(s).
- The Dissertation committee can be appointed only after the Qualifying Examination has been passed. See also “Advisory & Dissertation committee Responsibilities” section.

Each Ph.D. program of study, for students holding M.S. engineering degrees, must meet the following requirements:

Course Requirements

	<u>Credits</u>
• ABE 500 (required first fall semester unless previously taken)	3
• ABE 5XX and/or 8XX (excluding ABE 500, 590-596) ¹	6
• AEE 450 or 530 or HI ED 546 (B grade minimum)	3
• Communications (B grade minimum) ²	3
• Additional coursework as approved by Dissertation committee	___

Except as specified above, no particular course levels, total number of courses or total credits are required by the department. The Dissertation committee will determine the minimum requirements in such supporting areas as mathematics, engineering, agricultural/biological sciences, and physical sciences. The candidate is expected to develop a program of study and submit it to the Dissertation committee for consideration and approval. Typically, the total coursework is 36 credits beyond the M.S. In addition to the above listed course work requirements, every graduate student must fulfill the Scholarship and Research integrity (SARI) requirement. SARI requirement consists of two parts: 1) completion of ABE 500 with a grade of B or better, and 2) completion of online training program at <http://www.research.psu.edu/training/sari-> Responsible Conduct of Research (RCR) for Engineers. The online SARI requirement must be completed within one year from date of enrollment in the program of study. A copy of the completion certificate of the online training program should be given to the Graduate Program Coordinator. This will be placed in the student’s department folder.

¹One 5XX ABE course (3 credits) and one engineering graduate (5XX) course (3 credit) from the [selection list](#) approved by ABE faculty (see Graduate Program Coordinator) fulfills this requirement.

²B- does not meet this requirement

It is recommended that each Ph.D. student not holding an M.S. engineering degree will satisfy the intent of the M.S. degree coursework requirements specified elsewhere in this document. For these students the typical coursework total is anticipated to be higher than 36 credits.

Course Requirements - (continued)

Research credits (ABE 600) are in addition to coursework credits. The Dissertation committee will determine the minimum research credits but typically the total number is 24 credits beyond the M.S. All requirements for a Ph.D. degree, whether satisfied on this campus or elsewhere, must be completed within eight years after passing the Qualifying Examination.

A Ph.D. candidate is not required to have a minor field of study. However, if the student selects a minor field, the minor must consist of not fewer than 15 graduate credits above and beyond any credits used for a master's minor. The coursework must be concentrated in an area related to, but different from, that of the major. A minor program must meet the approval of the departments responsible for the major and the minor fields.

Communications Course Requirements

The purpose of the Communications Requirement is to strengthen the student's professional communication skills. The candidate must take AEE 450 or AEE 530 or HI ED 546. An additional 3-credit course in communications must be taken. A grade of B or better is required in each course (Note: getting a B- does not meet this requirement). Course selections must be approved by the Advisor prior to registration and must meet the expectations of the Dissertation committee. Courses used to satisfy this requirement cannot be courses taken as remedial for the Candidacy Exam and must include the substantial practice of writing and/or speaking. Examples of courses to consider are:

AEE 450	Program Design and Delivery (3)
AEE 530	Teaching and Learning in Agricultural Science (3)
AGCOM 462W	Advanced Agricultural Writing (3)
CAS 450W	Group Communication Theory and Research (3)
CAS 452W	Organizational Communication Theory and Research (3)
CAS 471	Intercultural Communication Theory and Research (3)
ENGL 417	The Editorial Process (3)
ENGL 418	Advanced Technical Writing and Editing (3)
ENGL 474	Issues in Rhetoric and Composition
ENGL 511	Thesis Workshop and Professional Writing (3)
ENGL 584	Studies in Rhetoric (3)
HI ED 546	College Teaching (3)

Any 3 credit 4XX foreign language course (Excluding 49X; Must not be candidate's native language).

Teaching Requirement

All Ph.D. students are required to participate in resident education or extension teaching activities for the equivalent of at least one semester during their graduate program. A plan to meet the teaching activity requirement must be prepared by the student and requires approval, first by the Advisor and then by the Graduate Program Coordinator. Approval should be obtained before commencement of the teaching activity. Teaching experiences beyond the minimum are encouraged and should be discussed first with student's Advisor and then Graduate Program Coordinator or Department Head.

Qualifying Examination

Ph.D. Qualifying Examination Committee - This committee **must** consist of four graduate faculty members from the ABENG program, including the Advisor, the Department Head (or annually appointed designee), the Graduate Program Coordinator and one faculty member selected by the student. In cases where a member serves two roles on the committee, an additional member will be appointed by the Graduate Program Coordinator.

The Candidacy Exam will consist of developing a Ph.D. research proposal, presenting the proposal, and defending/discussing the proposed research with the Committee. The Candidacy Exam will be completed by the student within the first four to nine months after entering the Ph.D. graduate program. Successful completion of the Candidacy Exam does not mean that the student's Ph.D. research proposal is approved. Rather, final approval of the candidate's research proposal will be the responsibility of the Dissertation committee.

Each Ph.D. student will submit to each Committee member a detailed proposal for the Ph.D. research a **minimum** of five working days prior to the exam. This proposal should contain justification, objectives, related literature, methodology, practical significance, resources required, bibliography, proposed program of study and a statement of possible funding sources to which the proposal could be submitted.

The student will present a 20-minute seminar to the Committee. The seminar is open to all in the department and participants may ask questions of the potential Ph.D. candidate concerning the proposed study, technical and engineering aspects, and other related items. The total seminar time will be limited to approximately 30 minutes. Upon completion of this seminar, the graduate faculty members and members of the Committee (may) hold a discussion period (no longer than approximately 15 minutes) regarding the student, the proposed research and the seminar. The student will not be present during this discussion period. Following this discussion, the Committee and the student will undertake the remainder of the exam.

The Committee will review the written proposal and discuss (up to 2 hours) with the student the proposed research and related topics. The Committee will assess the student's understanding of the research process, the student's technical expertise related to agricultural and biological engineering and the proposed research, suitability of the proposed research relative to departmental expectations of Ph.D. candidates, the student's understanding of needed resources and other pertinent topics. The Committee will also judge the ability of the student to communicate and will complete a "*Report on Departmental Assessment of English Competency*" (see "English Competency Requirements" section below). The Committee will select, based on the student's performance, one of the following: 1) recommendation that the student become a Ph.D. Candidate, 2) rejection of the student as a Ph.D. Candidate, or 3) recommendation that the student undertake additional activities as prescribed by the Committee and retake the Candidacy Exam. A student will not be allowed to take the Candidacy Exam more than twice.

English Competency Assessment

The Graduate School and the ABENG graduate program require candidates for the Ph.D. degree to demonstrate high-level competence in the use of the English language; including reading, writing, listening, and speaking. To fulfill this requirement, the ABENG program requires that all Ph.D. students undergo an assessment of English competency during the first year of their Ph.D. program. The assessment will include the student's ability to read and comprehend, write, speak, and give presentations so as to effectively participate in scientific and technical discussions. The assessment will be conducted during the Ph.D. Qualifying Examination by the Ph.D. Candidacy Exam Committee and will consist of three parts:

Writing—As part of the Ph.D. Qualifying Examination, the student will prepare a detailed research proposal on the topic chosen for his/her Ph.D. dissertation (see “Qualifying Examination” for further details about proposal). The written document will be judged for its organization, logical arguments in support of the hypotheses, inclusion of relevant details, and appropriate style in the use of language, grammar, punctuation and spelling. The “Literature Section” of the written proposal containing analysis of pertinent literature will be used to evaluate the student's reading comprehension of the technical literature.

Presentation—As part of the Ph.D. Qualifying Examination, the student will present a 20-minute seminar to the Committee. The seminar is open to all in the ABE department. The presentation will be judged for its organization, clarity, appropriateness to the audience, appropriate use of visual aids, and effectiveness of delivery. The quality of the formal presentation should be comparable to papers presented at technical sessions of professional society meetings.

Oral Discussion—The main purpose of the Oral Discussion part of the English Competency Test is to evaluate the oral skills of the student to participate in scientific and technical discussions with other technical professionals. The Oral Discussion will follow the formal presentation of the research proposal by the student. The examination committee will conduct a discussion with the student on various aspects of the research proposal and also on the scientific and technical issues surrounding the research area.

At the end of the Candidacy Exam, each member of the Committee will present an assessment of the student's English competency in the three categories: writing, presentation, and oral discussion. These assessments will be used to certify attainment of English competency or to recommend measures for improving English competency. A “Report on Departmental Assessment of English Competency” form will be completed by the Committee, shared with the student, and placed in the student's departmental records.

Improving English Competency of Students with Deficiencies—If the expected level of English Competence is not demonstrated, the student must enroll in course(s) to improve English competency. The committee will recommend suitable course(s) which may include selections from the following:

- Writing Skills
 - ESL 116G – ESL/Composition for Academic Disciplines
- Presentational Skills
 - CAS 100A – Effective Speech
 - CAS 211 – Informative Speaking
- Oral Language Skills
 - ESL 114G – American Oral English for Academic Purposes
 - ESL 115G – American Oral English for ITAs I

Residency Requirement

If the student completes and passes the recommended course(s) with a B-grade or higher, then the student will be certified as having attained English competency. Otherwise, the student will have to retake the course (or another comparable course). Students judged as not making sufficient progress towards achieving competency in English will have their funding terminated.

There is no required minimum number of semesters of study. However, over some twelve-month period during the interval between admission to the Ph.D. program and completion of the Ph.D. program, the candidate must spend at least two semesters (summer sessions are not included) as a registered full-time student engaged in academic work at the University Park campus, The Milton S. Hershey Medical Center, or Penn State Harrisburg. Full-time University employees must be certified by the department as devoting half-time or more to graduate studies and/or thesis research to meet the degree requirements.

Comprehensive Examination

When a Ph.D. candidate has substantially completed the coursework, including the communication requirements, he/she is required to take a Comprehensive Examination covering the major, minor, and related areas of study. The Comprehensive Examination should be scheduled through the Graduate Study Chair and the Graduate School at least two weeks prior to the selected date. All candidates are required to have a minimum grade point average of 3.00 for graduate work completed at the University at the time the Comprehensive Examination is given, and may not have deferred or missing grades. The student must be registered as a full-time or part-time student for the semester in which the Comprehensive Exam is taken. The Comprehensive Examination must be taken at least three months before the Final Oral Examination. If a period of six years has elapsed between the passing of the Comprehensive Examination and the completion of the program, the student is required to pass a second Comprehensive Examination before the Final Oral Examination can be scheduled.

The Comprehensive Examination will be both written and oral. The nature and details of the Comprehensive Examination will be determined by the Dissertation committee. In general, the student will be required to demonstrate ability to synthesize information acquired through formal coursework and to use technical literature to find information required for solving engineering problems. Accordingly, the Comprehensive Examination will consist of 1) The completion of a written examination provided by each of the Dissertation committee members prior to the oral examination; 2) A presentation of the candidate's research; 3) An oral examination that may cover content in the written examination research presentation or relevant subject matter. The written examination should conclude a minimum of one week before the oral examination. A favorable vote of at least two-thirds of the committee is required for passing. If a candidate fails, the committee will determine whether another examination may be taken. Results of the exam are reported directly to the Graduate School.

Final Oral Examination

Upon recommendation of the Advisor, a Ph.D. candidate who has satisfied all other requirements for the degree will be scheduled by the Dean of the Graduate School to take a Final Oral Examination. The scheduling form can be obtained from the Graduate Study Chair or Staff Assistant and must be submitted at least three weeks prior to the scheduled exam date. The student must be a registered full-time or part-time degree student for the semester in which the Final Oral Exam is taken. This examination is open to the public and the student should notify all departmental faculty and graduate students. The examination is related largely to the thesis, but may cover the candidate's entire field of study without regard to courses that have been taken either at Penn State University or elsewhere. The defense of the thesis should be well-prepared including any appropriate visual aids. One of the aims of the preparation should be to synthesize the important conclusions in a time-efficient presentation, leaving ample time for questions and discussion. A favorable vote of at least two-thirds of the committee is required for passing. If a candidate fails, the committee will determine whether another examination may be taken. Results of the exam are reported directly to the Graduate School.

Schedule for Ph.D. Requirements

Many of the requirements for the Ph.D. degree are listed in approximate chronological order on the following page. It is the student's responsibility to ensure that these and all other requirements are met in a timely manner. It is expected that Ph.D. students should complete the degree in about 36 months and departmental assistantship support (if awarded) to a Ph.D. student is granted for no more than 36 months.

SUMMARY SCHEDULE FOR PH.D. DEGREE

Requirement	Suggested Completion Dates
Recommend permanent Advisor.	Middle of first semester.
Submit to Advisor a list of courses to comprise Ph.D. plan of study.	End of first semester.
Complete semiannual report form.	Each January and July.
Schedule and complete Ph.D. Qualifying Examination.	Beginning of second semester.
Submit thesis research project proposal to Advisor.	Within one month following Qualifying Examination.
Recommend to Graduate School faculty members to serve on Dissertation committee.	Within one month following Qualifying Examination.
Submit plan of study and thesis project proposal to Dissertation committee for approval (copy to Graduate Program Coordinator).	Middle of second semester.
SARI Online Requirement, http://www.research.psu.edu/training/sari	Complete the online requirement within one year from the date of enrollment in the program of study. Give a copy of the completion certificate to the Graduate Program Coordinator.
Resident education or extension teaching.	Prior to Final Oral Examination.
Schedule and complete Comprehensive Examination.	Upon substantial completion of coursework and 3 months prior to Final Oral Exam.
Apply to graduate in LionPATH.	Beginning of semester or summer session in which degree is expected.
Pay thesis fee through the Graduate School Payment Portal at https://secure.gradsch.psu.edu/paymentportal/ .	Beginning of semester or summer session in which degree is expected.
Submit draft copy of thesis to Advisor.	Early in last semester.
Schedule Final Oral Examination and distribute copies of thesis to each committee member and Graduate Program Coordinator	Distribute thesis only AFTER the thesis has been approved by Advisor.
Present departmental seminar based on results of thesis research; schedule through Seminar Chair.	After Final Oral Exam, if practical; otherwise, as close to it as is practical.
Submit original copy of thesis to Department Head for signature; then to Graduate School.	After Committee signs and prior to Graduate School deadline.
Prepare manuscript(s) for publication based on thesis research activity.	Prior to departure.
Departure meeting with Department Head.	Two weeks prior to departure.
Disassemble research apparatus and clean as necessary; return equipment and supplies to designated areas. Clean office, desk and file space; empty all drawers and shelves and remove posters.	Prior to departure.
Return departmental keys, books, software, supplies, etc. to Administrative Assistant.	Prior to departure.
Provide an electronic copy of dissertation to Advisor.	Prior to departure.

Other Degrees

Minors in Agricultural and Biological Engineering

A student pursuing a master's degree in a field other than ABENG may earn a minor in ABENG by completing at least 9 credits of 4XX or 5XX ABE courses. No more than a total of 3 of the minimum credits may be earned in 49X or 59X courses.

A minor in ABENG for a Ph.D. student must consist of no less than 15 credits of 4XX or 5XX ABE courses. No more than a total of 6 of the minimum credits may be earned in 49X or 59X courses. If the student received a master's minor in the same field as is being proposed for a Ph.D. minor, the 15 credits taken must be above and beyond those used for the master's minor. At least one faculty member from the minor field must be on the candidate's Dissertation committee.

Degrees in Intercollege and Dual-Title Degree Programs

As an alternative or addition to the M.S. and Ph.D. degrees in ABENG, a student may pursue a graduate degree in an intercollege or dual-title degree programs and be advised by a faculty member in the ABE Department. For example, a number of students in the intercollege Environmental Pollution Control (EPC) program and the dual-title Operations Research (OR) program have been advised by faculty members in ABE. The most recent dual-title program available to ABENG students is the International Agriculture and Development (INTAD). These programs are offered under the supervision of appropriate interdepartmental or intercollege committees.

Students in these programs should consult with the person listed under the major program heading in the Graduate Bulletin for information regarding admission, course selection and degree requirements. When students in such programs are advised by ABE faculty, they must be familiar with, and adhere to, the administrative policies detailed in this handbook. In general, the academic policies also apply to these students, but may be superseded or supplemented by policies promulgated for the students' specific majors. Students are required to give a seminar on their thesis research and attend all ABE departmental seminars. The required seminar presentation may be in a departmental or program series other than ABE.

Additional information about the EPC, INTAD, and OR can be found at (1) Environmental Pollution Control (EPC) <https://bulletins.psu.edu/graduate/programs/majors/environmental-pollution-control/>, (2) International Agriculture and Development (INTAD) <http://agsci.psu.edu/international/intad>, (3) Operations Research (OR) <http://www.or.psu.edu> and <https://bulletins.psu.edu/graduate/programs/majors/operations-research/>.

Academic Policies

Registration

The responsibility for being properly registered rests first with the student and secondarily with the Advisor. A student may register for coursework or research or both. In the case of research, the number of credits shall be determined by the amount of time devoted to the investigation, with 1 credit representing the approximate equivalent of one week of full-time work.

An M.S. candidate is required to register continuously but is not required to register for the final semester in order to graduate or in order to make minor revisions to the thesis and/or take a final examination for the degree.

A candidate for the Ph.D. degree is required to register continuously for each semester from the time the comprehensive examination is passed until the thesis is accepted by the Dissertation committee, regardless of whether work is being done on the thesis during this interval.

If all degree requirements (including thesis defense and thesis submission) are completed prior to the beginning of the semester in which the student will be graduating, then the student is not required to register for that semester. For example, if a student is planning to graduate at the end of fall semester, then he/she must either complete all degree requirements two days prior to the first day of fall classes, or register for the appropriate number of credits for the fall semester. Courses to meet continuous registration requirements are:

- ABE 600/610—If a student does not need to maintain full-time status, he/she should register for the appropriate number of thesis credits (determined in consultation with Advisor) which accurately reflects the amount of research being done on the thesis. ABE 600 is for students who will be on campus; ABE 610 is for students who will be off campus.
- ABE 601/611—This special registration may be used only by Ph.D. students starting with the semester after the Comprehensive Examination is passed. If a student must maintain full-time status for an assistantship, fellowship, bank loan deferment, etc., ABE 601 would be an appropriate registration. ABE 611 is the appropriate course for a part-time Ph.D. student. To register for ABE 601, students must be devoting their degree efforts entirely to thesis research/writing.

International Students—International students must satisfy additional registration requirements set by the Immigration and Naturalization Service (INS) and others. Further information can be found at: <http://global.psu.edu>.

Graduate Assistants—Graduate assistants must be enrolled at Penn State as graduate students. More specifically, since assistantships are provided as aids to completion of advanced degrees, assistants are expected to enroll for credit loads each semester that fall within the limits indicated in the table below. Maximum limits on permissible credit loads help assure that the student can give appropriate attention both to academic progress and assistantship responsibilities.

Level of Assistantship	Credits per Semester		Credits per 6-Week Summer Session	
	Minimum	Maximum	Minimum	Maximum
Quarter-time	9	14	5	7
Half-time	9	12	4	6
Three-quarter-time	6	8	3	5

Graduate assistants whose credit loads equal or exceed the minimum indicated in the table, and whose assistantship activities are directly related to their degree objectives, are considered by the Graduate School to be engaged in full-time academic work.

Dropping Courses

Each graduate student must maintain full-time registration throughout each semester or summer session in order to continue receiving assistantship support.

Each request to drop a course must be approved by the Advisor.

A student receiving tuition remission must recognize that if he/she drops a course, the tuition already paid out of the departmental allocation is lost and can never be recovered. Excessive dropping of courses will mean that tuition support may not be available in the future.

Normal Academic Progress

Students are expected to complete the minimum credit requirement each semester and maintain an acceptable academic grade point average (3.00 minimum). Students who fall below these standards will be considered to be on academic probation. If a student remains below these standards for two consecutive semesters, his/her enrollment may be terminated.

Each student has the responsibility to submit a Progress Report form each January and July to the Graduate Program Coordinator. The report must have the Advisor's comments and signature and must be submitted on time if the graduate student is continuing in the next semester (or summer session). If a student receives unsatisfactory evaluations in two consecutive progress reports, his/her enrollment in the graduate program may be terminated; subject to a meeting between his/her advisor, the Graduate Program Coordinator, and the Department Head.

Advisory and Dissertation committee Responsibilities

Each Advisory and Dissertation committee has the following responsibilities:

- Review and approve the graduate student's plan of study.
- Consult with and advise the graduate student on research approach, techniques, findings, and reports.
- Review and approve the graduate student's thesis research project proposal before substantial steps are implemented to do the research.
- Review the graduate student's thesis and suggest improvements.
- Monitor and evaluate the student's progress in meeting course and research requirements for the degree.
- Conduct required examinations for the candidate's degree program. For the M.S. degree, the required examination is the Final Oral Examination. For the Ph.D. degree, the required examinations are the Comprehensive and Final Oral Examinations.

A two-thirds majority vote from the Advisory or Dissertation committee members is required to approve the plan of study and research proposal, pass examinations, and approve the thesis.

Plan of Study

A plan of study is required so that no student proceeds without advice and guidance on earning an advanced degree. The graduate student, in close consultation with the Advisor, is expected to develop a tentative plan of study by the end of the first semester. The plan of study is to be submitted for approval to the Advisory or Dissertation committee by early in the second semester for a M.S. student and within one month after completing the Qualifying Examination for a Ph.D. student. An electronic copy of the approved plan of study is to be submitted to the Graduate Program Coordinator for placement in the student's file.

The plan of study for a Ph.D. student is to include all course credits and thesis research credits to be completed (or already completed) after the B.S. degree. If any course credits or thesis research credits were earned at another institution, then the institution should be identified on the plan of study.

Each plan of study is unique to the individual student and should be tailored to meet his/her career goals and objectives. The plan should be reasonably cohesive and concentrate in an area or interrelated areas of study. Since a plan of study is developed quite early, a student may modify his/her plan with approval by the Advisor and the Advisory or Dissertation committee.

Statistical Consulting Services

The Statistical Consulting Center (<http://stat.psu.edu/consulting/statistical-consulting-center>) is an educational and service unit in Penn State's Department of Statistics. Faculty, staff, and graduate and undergraduate students from Statistics, Computer Science/ Engineering, and Management Science/Information Services provide advice, project management, data management, and statistical analysis for the University and private research community. The Center provides walk-in, short term, and longer term consulting services to graduate students, staff and faculty. Short-term services include two free consultation meetings; whereas longer term services are on an arranged-fee basis.

It is recommended that each student consult with the Statistical Consulting Service during the planning of experiments and prior to data collection, to assure that adequate consideration has been given to statistical analysis.

Thesis Guidelines and Specifications

A degree candidate must demonstrate ability to do independent research and competence in scholarly exposition by the preparation of a thesis on a topic related to the major subject. The thesis should represent a significant contribution to knowledge, be presented in a scholarly manner, reveal an ability on the part of the candidate to do independent research of high quality and indicate considerable experience in using a variety of research techniques. In conformance with the Family Educational Rights and Privacy Act, students are hereby notified that their thesis and other research work may be made publicly available through libraries and other means.

The thesis is to be developed by the student with the supervision, support and critique of the Advisor. The draft thesis is to be submitted first to the Advisor. The student and the Advisor may agree to prior review of the thesis, either section-by-section or in its entirety, or both. After the thesis has been approved by the Advisor, the student distributes a copy to each member of the Advisory or Dissertation committee. This draft should be complete in every respect including figures, tables and bibliography; the content and style should be correct and polished.

Graduate students should allow a minimum of five working days before the Final Oral Exam for Advisory or Dissertation committee members to review the thesis. Some members may require more time. Time for thesis reviews can often be reduced considerably if the graduate student notifies the committee members in advance of the date when copies will be submitted for review.

Acknowledgments. A student is highly encouraged to acknowledge the funding source(s) in the acknowledgments section of the thesis. In all cases, the Penn State College of Agricultural Sciences should be recognized for the contributions it has made to the student's thesis research activities. If the student or the student's research is additionally supported by a contract or grant activity, then it is highly appropriate to acknowledge the source of the external support. An example appropriate statement to acknowledge the support is "Thank you to <Department Head's name> for providing financial support from the Penn State College of Agricultural Sciences throughout my graduate study" or, more simply, "The support received from the Penn State College of Agricultural Sciences is gratefully acknowledged."

Units. All theses must be in SI Units. Customary units may be included in parentheses for special applications.

Thesis Typing. The Graduate School offers the thesis template, which can be found at <http://www.gradsch.psu.edu/current/thesis.html>. The thesis is to be completed at the student's expense. Departmental microcomputers may be used for thesis preparation under the following conditions:

- The equipment may be used only by the student.
- The student will readily relinquish the use of the equipment when needed by students or others for extension, research, or teaching purposes.
- The printers are not to be used for multiple copies.

Graduate Seminar

Submission of Thesis. The thesis must meet the Graduate School's format and other requirements. The Office of Theses and Dissertations at: <http://www.gradsch.psu.edu/current/thesis.html> publishes a "Thesis Guide" <http://www.gradschool.psu.edu/current-students/etd/thesisdissertationguidepdf/> and provides thesis writers workshops several times each semester. In addition to Graduate School requirements, the student must provide an electronic copy to the Thesis Office and his/her Advisor.

(Advisors and the Advisory or Dissertation committee may require additional copies, perhaps in bound or other formats. The cost of any additional copies required by the sponsor of the research project will be covered by the project funds.)

A graduate student must present a departmental seminar at the termination of each degree program, based on his/her thesis project. Seminars should be scheduled through the Seminar Chair, be during the regular seminar time slot, and be after the Final Exam or at least as close to the end of the degree program as is practical.

Graduate students **must** attend all department seminars each semester unless they have course conflicts and are encouraged to suggest topics and speakers to the seminar committee. Seminar attendance after passing the Final Oral Exam is optional.

If a student has a regularly scheduled course during the seminar period, then the student must inform the Graduate Program Coordinator at the beginning of the semester prior to the first scheduled seminar. A student may miss up to three seminars per semester without any penalty. If the number of missed seminars exceeds three, this absence will be noted on the student's progress report and the department may withdraw funds for travel to conferences and/or other departmental support. No remedial action will be required if the student provides evidence of attending seminars elsewhere at PSU; equal in number to the missed seminars during the same semester. The substitute seminars must be part of an organized series or a special event and cannot be seminars given as part of a graduate committee event.

Participation in Departmental Activities

All graduate students are invited and encouraged to attend department meetings, retreats, seminars, socials, and all other activities. However, at the discretion of the Department Head, some departmental activities may be for only the faculty.

Graduate students are also invited and encouraged to become involved with departmental committees. Graduate students may not serve on the Graduate Applications Subcommittee to avoid any possible conflict of interests. Graduate student members of committees shall have full voting rights.

Student Organizations

The Agricultural and Biological Engineering Graduate Student Council (ABEGSC) is the department's graduate student organization. This group holds meetings and events on a regular basis. Each graduate student is highly encouraged to proactively participate in the ABEGSC. In addition, there are several student organizations responding to the needs of graduate students. The largest group is the Graduate Student Association (GSA) which is a university-wide group consisting of representatives from each department. GSA provides a liaison between ABE graduate students and University Administration and acts as both a lobbying group for student issues (such as insurance and taxes) and as a social organization providing such opportunities as happy hours and the summer rental of garden plots. The Engineering Graduate Student Council (EGSC) performs a similar function by providing a communication link to the College of Engineering. EGSC often sponsors panel discussions and brown-bag lunches while also having input on various college advisory committees. Representatives for both of these groups are elected from within the department near the end of each spring semester.

The diversity among graduate students is reflected by the number of ethnic and social groups available to students. Among the many groups are: Friends of India (FOI), Women in Science and Engineering (WISE), and the Black Caucus. The Penn State Outing Club has many divisions including canoeing, hiking, biking, skiing, and equestrian.

Post-Graduation Employment

Assistance finding employment is available at the department, College, and University levels. The Agricultural Sciences Careers Fair is held each fall and attracts about 50 employers. University-wide career fairs are held each September and April in Bryce Jordan Center. Career Services (<http://studentaffairs.psu.edu/career/>) provides assistance in the following areas:

- Drop-In & Career Counseling
- Nittany Lion Career Network
- Job Search and Career Fairs
- Workshops & Events
- Career Information Center
- Education Credentials Services

Student Petitions

A graduate student has the right to submit a petition concerning any academic and/or administrative policy related to the graduate degree program. Generally, a petition needs to be approved by the Advisor and the Advisory or Dissertation committee and then sent to the Graduate Studies Chair who will forward the petition as appropriate. The Department Head, in consultation with the Graduate Studies Committee, will make the final decision on petitions relating to policies and requirements promulgated by the department. In all cases, a petition must be submitted as early as possible so that the student has time to develop alternative plans if the petition is denied. Problems that develop between a student and member(s) of the Advisory or Dissertation committee can be arbitrated on a confidential basis by the Department Head and/or Dean of the Graduate School, as appropriate.

Administrative Policies

Assistantship Responsibilities

A graduate student on a 1/4-time assistantship is expected to work a minimum of 10 hours per week on activities that are in compliance with the overall departmental objectives as determined by the Advisor. Students on 1/2-time or full-time assistantships are expected to work on a similar basis for a minimum of 20 hours or 40 hours per week, respectively. These work requirements may include thesis research activities.

To allow for obtaining a broad base of experiences and professional growth, each graduate student is encouraged to seek involvement with the Advisor and/or Advisory/Dissertation committee members to gain teaching (classroom or extension) experiences as a part of the graduate education. This experience is expected for all Ph.D. candidates. In addition, each Ph.D. candidate should seek involvement with his/her Advisor to write and submit a research proposal for external funding. Each graduate student should discuss the opportunities for participation in teaching and proposal preparation with his/her Advisor and the Department Head.

The Test of Spoken English (TSE) is required of graduate students whose native language is not English before such students can be appointed to graduate teaching assistantships. Students who score less than 220 on the TSE will not be permitted to hold teaching assistantships.

Work Related Injury

The University covers its employees with Worker's Compensation Insurance as a protection for injuries or illness compensable under the Pennsylvania Worker's Compensation Act.

An employee has an obligation to report any work-related injury, regardless of how minor, to his or her supervisor. The employee will be provided with a "Workers' Compensation Employee Notification" form and a copy of the "Healthcare Provider Panel" list. Any treatment for the first 90 days from first treatment must come from a "Panel" provider in order to ensure that the University will pay for medical treatment. If the injury results in an immediate medical emergency, initial medical assistance may be obtained from a hospital or health care provider of the employee's choice. However, subsequent treatment must be from a "Provider Panel" participant.

Additional information on this topic can be obtained from the following link: <https://hr.psu.edu/workers-compensation>

Health Insurance

The Student Insurance Office is responsible for administering two health insurance plans for graduate students. A graduate student who is on a Graduate Assistantship or Graduate Fellowship is automatically enrolled in the Penn State Graduate Assistant and Graduate Fellow Health Insurance Plan, and the Vision and Dental Plans, which also provides coverage for eligible dependents. Penn State will provide a subsidy of 80% of the annual premium cost for the graduate assistant or fellow and deduct the student's 20% contribution from the monthly paycheck. Health insurance subsidy for eligible dependents is 70% of the annual premium expense. To enroll a spouse and/or dependents for Medical, Dental, and Vision benefits, graduate students must complete the "*Online Dependent Enrollment Form*" within the initial website listed below.

Graduate students not on an assistantship or fellowship may enroll in the Penn State Student Accident and Sickness Insurance Plan. All international students and their accompanying dependents (spouse and/or children) must have health insurance coverage. This may be fulfilled in one of two ways:

- Purchase the Penn State Student Accident and Illness Plan
- Acquire a comparable health insurance plan and provide the University with documentation that provides proof of insurance by submitting a waiver application to the Student Insurance Office.

Further details regarding student health insurance are available at the University Health Services Office, 302 Student Health Center, phone 814-865-7467, or visit: <https://studentaffairs.psu.edu/health-wellness/health-insurance>.

Publications

Graduate students are expected to submit manuscripts for publication of their research findings. The Advisor and others involved directly with the research project are to be listed as co-authors. It is recognized that graduate students may, in spite of encouragement to the contrary, leave the University without preparing manuscripts to submit for publication. Six months after the student leaves the University, the Advisor can use the thesis and research data to prepare a manuscript for publication (if the student has not already done so) with written notification sent to the graduate student. Under this arrangement, the Advisor would be the senior author and the former student would be a co-author.

Manuscripts to be published can be in various formats including refereed journal articles, fact sheets, and extension circulars. It is especially important that Ph.D. students develop at least three refereed journal articles based on the dissertation research activity. Expenses for the preparation of manuscripts for publication based on theses are considered legitimate departmental expenses and will be paid by the department. However, expenses for thesis preparation are considered personal expenses and must be paid by the student.

All research data, patents, designs, computer software, creations, slides, pictures, reports, etc. obtained by graduate students on assistantship support are the property of the ABE Department. All research data and other requested materials must be submitted to the Advisor before the student leaves Penn State University. If any patents or copyrights are awarded to the inventions or designs of any graduate student's thesis research, then both the student and Advisor are credited. They can receive a percentage of the profits or royalties realized from the patents or copyrights.

Research Data, Software, Designs, and Manuscripts

Professional Ethics

Penn State policy AD-47 sets forth statements of general standards of professional ethics to serve as a reminder of the variety of obligations assumed by all members of the academic community, including graduate students. The handling of inquiries into questions of ethics is covered in RA-10. RA-13 deals with the co-authorship of scholarly reports, papers, and publications. These policies are available from the departmental administrative assistant.

Academic Integrity

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others. Students should read and become familiar with The Pennsylvania State University Policies AC47 *General Standards of Professional Ethics*; AD67 *Disclosure of Wrongful Conduct and Protection From Retaliation*; and AD88 *Code of Responsible Conduct*.

Academic Integrity Guidelines for the College of Agricultural Sciences can be found at <http://agsci.psu.edu/students/resources/academic-integrity>.

A lack of knowledge or understanding of the University's Academic Integrity policy and the types of actions it prohibits and/or requires does not excuse one from complying with the policy. Penn State and the College of Agricultural Sciences take violations of academic integrity very seriously. Faculty, alumni, staff and fellow students expect each student to uphold the University's standards of academic integrity both in and outside of the classroom.

Disability Statement

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable accommodation in the ABENG graduate program, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>.

In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at <http://equity.psu.edu/ods/guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.

Travel to Professional Meetings

Graduate students registered full-time will be provided with \$300.00 support plus surface transportation to attend **one** national ASABE meeting (or comparable professional meeting) while pursuing a graduate degree. Each full-time graduate student will be encouraged to attend additional ASABE meetings with this level of support when he/she is senior author of a paper that he/she is presenting. Surface transportation will be provided, as resources allow, for all graduate students to the ASABE meetings regardless of how many times they have attended previously. Support for graduate students to attend other national professional meetings may be provided with the recommendation of the Advisor. This travel support is provided to graduate students from general departmental funds to further stimulate professional growth and development. Budget constraints may dictate that this travel support be reduced at times. Additional financial support for attending the meetings is available through the College of Agricultural Sciences, http://agsci.psu.edu/graduatestudents/funding-opportunities/copy_of_travel-awards.

Office and Key Assignments

Office space is assigned to graduate students on a space-available, priority basis; assignments are made by the Graduate Studies Chair. Priority of office space is generally given in the order of: 1) graduate students with assistantship support; 2) full-time graduate students without assistantship support; 3) full-time graduate students on provisional admittance; and 4) part-time graduate students.

Nearly every graduate student desk has a desk-top bookshelf. To preserve the high-quality of the desk-top bookshelves, please do not fasten anything to the bookshelves with tape, glue, thumbtacks, staples, nails, etc. These bookcases were made from high-quality, cabinet-grade oak plywood and they will be attractive for many years if they are properly cared for today. Upon request, a small bulletin board will be provided to each graduate student for mounting items rather than fastening them to the bookshelf. Keys are available for most desks.

Door keys will be assigned to graduate students by the Administrative Assistant; assigned keys will unlock exterior doors and doors to graduate student offices and many labs. If a graduate student needs access to other facilities, an appropriate key will be assigned.

Graduate students must return keys assigned to them upon completion of their graduate program. Keys are not to be loaned to anyone and it is unlawful to duplicate them. GRADUATE OFFICE DOORS ARE TO BE KEPT LOCKED WHENEVER NO ONE IS PRESENT IN THE ROOM.

Recycling

Each graduate student is expected to participate in recycling, per Policy AD34 University Recycling Program. Recycling Guidelines are posted on departmental bulletin boards.

Smoking

For the consideration of health, comfort, and safety of all people in the department, SMOKING IS NOT ALLOWED IN ANY FORM IN ANY AREA of the Agricultural Engineering Building or in any University vehicles.

Regulatory Compliance

Human Research Subjects. University policy requires institutional review and approval of all activities that involve using human subjects in research. A human subject is defined as an individual about whom an investigator (whether professional or student) conducting research obtains (1) data through

intervention or interaction with the individual, or (2) identifiable private information. Contact the Office for Research Protections, The 330 Building, Suite 205, University Park, PA, or phone 814-865-1775 or e-mail orp@psu.edu or <https://www.research.psu.edu/orp>, for more details.

Vertebrate Animals. Approval by the University's Institutional Animal Care and Use Committee (IACUC) is required prior to the involvement of a vertebrate animal in any University activity. This policy applies to non-human vertebrate animals, live or dead, and parts thereof, excluding established cell lines, biological fluids, and conventional foods. Contact the Office for Research Protections, The 330 Building, Suite 205, University Park, PA, or phone 814-865-1775 or e-mail orp@psu.edu or <https://www.research.psu.edu/orp>, for more details.

Biohazardous Materials. All University research and teaching activities involving biohazardous materials shall be reviewed and approved by the University Biosafety Committee prior to the use of any such reagent. Included are carcinogens, toxins, infectious agents, recombinant DNA, and human body fluids or tissue. Contact the Office for Research Protections, The 330 Building, Suite 205, University Park, PA, 814-865-1775, orp@psu.edu, or Office of Environmental Health and Safety, 6 Eisenhower Parking Deck, 814-865-6391, for more details.

Hazardous Materials. All hazardous materials must be properly handled, including proper waste disposal. Contact your Department representative (Randall Bock, rgb@psu.edu) before reaching out to the Office of Environmental Health and Safety, 6 Eisenhower Parking Deck, 814-865-6391, for more details.

Purchasing

Materials, supplies, equipment and travel required for conducting research contributing to a departmental research program will be supported by the department with state and federal funds and special grants.

All purchases made for extension, research, and teaching activities, whether related to thesis research or not, must be approved in advance by the Advisor and should be made using a Penn State Purchasing Card whenever practical. The policy of the department with respect to purchases is as follows:

- A graduate student must obtain approval of the Advisor before ordering or picking up material.
- The signed receipt must be attached to a yellow reconciliation form and submitted as soon as possible but no later than three working days to the Administrative Assistant.
- These receipts are kept on file by the Administrative Assistant to be checked against the monthly bills.

Supplies and Support Services

Requests for supplies and support services, especially including the assistance of secretaries and technicians, are to be channeled through the Advisor. Supplies and services are restricted to work in support of research activities with approval of the Advisor. However, expenses related to coursework and thesis preparation are considered personal expenses and must be paid by the student.

Graduate students are expected to write manuscripts for publication based on thesis or technical projects and to participate with faculty in the preparation of grant proposals. Related expenses are considered legitimate departmental

Computers and Access Accounts

expenses and, with Advisor approval, necessary supplies and support services will be made available.

The department has a microcomputer lab in room 309, Agricultural Engineering Building that is available for graduate student use. All lab computers are directly connected to the university network backbone for full Internet capabilities.

All students will be assigned an access account by the university. Account IDs and passwords can be obtained by showing proper identification (student ID) at any public computer laboratory on campus, which can be found at <http://lat.tlt.psu.edu/>. The access account provides electronic mail support and other privileges. All microcomputers in the department support electronic mail and Internet access programs.

Microcomputers in rooms 309, Ag E Building are available for coursework, research, and any university-related use. In addition, they can be used for professional development materials such as thesis, resumes, letters, etc. However, use of laser printers for personal use, including professional development items, will cost 10 cents per page, payable to the Administrative Assistant.

No software may be placed on any departmental computer without permission of the computer systems manager and/or Advisor. Commercial software on these computers may not be copied at any time. Graduate students can be allocated storage space on a server by requesting it from the systems administrator with approval of your advisor. Personal files should be kept on a USB drive, since all personal files and unofficial software will be removed periodically.

Occasionally, instructors will reserve the computer lab for a particular class period. During these times, the class has priority on the lab computers. However, in many cases the instructor will allow use of open computers during that time. Please check with the instructor who reserved the lab if you desire to use a computer during that time.

Graduate students have access to the computer lab after regular work hours. It is the student's responsibility to lock the doors in the computer room when leaving during the hours of 5:00 p.m. to 8:00 a.m. and during weekends and holidays.

Fabrication Lab

Students are expected to fabricate experimental equipment needed for their thesis research if the equipment is not otherwise available. Students must follow all guidelines and policies, found at

<http://abe.psu.edu/research/facilities/fabrication-lab>. Please note the following:

- The Fabrication Lab is intended only for extension, research, and teaching activities.
- All graduate students must attend and satisfactorily complete workshops of instruction on the proper, safe use of facilities and tools. Upon completion of this course, the graduate student will be extended the privilege of Fabrication Lab access. See Fabrication Lab Supervisor for more details. Faculty and staff are expected to complete the workshops as well.
- Eye protection (safety spectacles or cover goggles) and disposable hearing protection are available free of charge to all graduate students upon their initial employment. This equipment is considered the property of the individual student. It is recommended that an individual wearing prescription glasses use the cover goggles on top of prescription glasses.
- Each graduate student shall use the personal protective equipment when working with any of the tools, equipment, and facilities in the Fabrication Lab. Safety instructions, more specialized safety equipment, and reminders are mounted on or near the tools, equipment, and facilities. If there is ever any doubt concerning the safe, proper use of any of the tools, equipment, or facilities, please check with the Fabrication Lab Supervisor.
- A graduate student may not permit people outside the department to use any departmental equipment, facilities, or supplies.
- In cases of extensive or complex fabrication, personnel may help with the work or the work may be contracted out. Use of personnel must be arranged by the Advisor in advance. Graduate students should not use general Lab supplies (steel, plastic, pipe, wood, etc.) without prior approval of the Fabrication Lab Supervisor and Advisor.

Use of University Vehicles

University vehicles are for OFFICIAL USE ONLY. Operators of university vehicles must abide by all highway laws. Special courtesy to other drivers should be exercised at all times, since one is representing the department, University and Commonwealth when driving a university vehicle. Only University students and employees may be passengers in university vehicles unless others have been authorized to participate in official business. An operator should check with the Department Head or the Advisor to determine whether a non-employee has been authorized to ride.

Requirements to operate university vehicles include that the drivers have a driver's license that is valid in Pennsylvania and be an employee of the University. Only those graduate students who are receiving an assistantship, fellowship, or wages from Penn State are employees. Students operating University vehicles must check with the Fabrication Lab Supervisor concerning procedures for signing out vehicles, purchasing fuel, and maintaining vehicle records.

Telephone Usage

Telephones are provided for use by graduate students for official business. One telephone is located in each of the large graduate student offices. These phones do not have long distance calling capabilities except for toll-free calls (1-800) and calls charged to a telephone credit card. Please do your part to answer the phone and take messages.

Documents to be sent by Fax should be submitted with an office staff work request form. Neither the Fax machine nor any telephone may be used for personal long distance calls. Exceptions may be made for an occasional important call, but only with office staff permission and only if arrangements are made in advance to determine and pay toll charges. Anyone anticipating the need to make many personal long distance calls should obtain a telephone charge card from any of the long distance providers. Phone calls and faxes to discuss job opportunities with potential employers, interview arrangements, graduate school opportunities, etc. are considered personal and must be paid by the student.

Books and Periodicals Collection

The department maintains a collection of books and periodicals including handbooks, basic textbooks and reference periodicals. The collection also includes company catalogs and journals. Material is acquired continually as funds permit based on suggestions from faculty and students. Undergraduate students and students outside the ABE Department are not allowed to take publications out of the reference room. If it becomes necessary, then the publication should be checked out by their instructors. Duplicates of most of the materials are available in Pattee and Engineering Libraries.

The following procedures apply to the use of the collection:

- Normally the material should be used in the reference room. The material should be put back in its correct place after use.
- The use of material outside the reference room is permitted only on the following conditions: 1) it is properly checked out, and 2) it is accessible to anybody who wants to use it. See the Administrative Assistant for checking out a book.
- *Resource, Agricultural Engineering, Transactions of ASABE, Applied Engineering in Agriculture, Canadian Agricultural Engineering, Journal of Agricultural Engineering Research*, and books from the reference shelves may not be checked out, except for immediate photocopying.
- Books may be taken out of the building after 5:00 p.m. on workdays only if they are returned to the building before 8:15 a.m. on the next work day.
- Instructors with students using the reference room are responsible for instructing their students about procedures.
- The department receives magazines, newsletters, and journals by subscription and as shared by individuals. A list of all publications for circulation is maintained in the main office. Graduate students should check with the staff assistants to indicate the publications they would like to receive by circulation, or if they would like to share for circulation a publication to which they subscribe.
- *Agricultural Engineering, Transactions of the ASABE* (with the index) *Canadian Agricultural Engineering, Applied Engineering in Agriculture*, and *Journal of Agricultural Engineering Research* are bound.

Graduate Faculty

Rachel Brennan (rbrennan@enr.psu.edu)
Ph.D., University of Illinois at Urbana-Champaign, 2003
Associate Professor
Ecological wastewater treatment, bioremediation of soil and groundwater contaminants

Nicole Robitaille Brown (nrb10@psu.edu)
Ph.D., Virginia Tech, 2004
Associate Professor
Biobased materials chemistry and physical properties

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Ph.D., Lehigh University, 1995
Professor
Cellulose synthesis and organization, nanofabrication and nanocharacterization, molecular and catalytic motors and sensors, plasmonics

Daeun Choi (dxc519@psu.edu)
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Robotics/machine vision applications in specialty crop production

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Ph.D., Cornell University, 2000
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Bioenergy

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Ph.D., Iowa State University, 1992
Professor
Microbial food safety engineering; industrial microbiology/fermentation

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Professor
Fate and control of pollutants in soils and water

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Professor
Environmental biophysics, ventilation systems, air quality

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Ph.D., Purdue University, 2011
Assistant Professor
Fate and transport of emerging contaminants; water quality; best management practices; green stormwater infrastructure

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Associate Professor
Food Engineering, Food Rheology

Long He (luh378@psu.edu)
Ph.D., Yanshan University, 2010
Assistant Professor
Mechanization & Automation for Specialty Crops, Precision Agriculture

***Graduate Faculty
(continued)***

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Ph.D., University of Florida, 1985

Professor and Head

Systems modeling; mushroom production, odor and air emissions; advanced sensors for food quality evaluation

Armen Kemanian (kxa15@psu.edu)

Ph.D., University of Washington, 2003

Associate Professor

Production systems and modeling; crop ecology and management

Jude Liu, (jxl179@psu.edu)

Ph.D., University of Manitoba, 2005

Associate Professor

Machine development for biomass harvesting and processing, and bioenergy utilization.

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Ph.D., Pennsylvania State University, 2013

Assistant Research Professor

Automation and mechanization of biological systems and processes

Judd Michael (jhm104@psu.edu)

Ph.D., Pennsylvania State University, 1994

Professor

Sustainable enterprises, packaging, entrepreneurship, business management

Michael Pate (mlp79@psu.edu)

Ph.D., Iowa State University, 2009

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Agricultural Safety and Health, Agricultural Systems Management

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Ph.D., University of Delaware, 1976

Distinguished Professor

Properties of food products; numerical methods; agricultural and food particulates

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Ph.D., Purdue University, 2013

Assistant Professor

Storm water management, watershed analysis, application of computational methods in watershed analysis, ecohydrological impacts of climate and land use change

***Graduate Faculty
(continued)***

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Ph.D., Cornell University, 1997

Professor

Microbial bioconversion processes; sustainable manure management

C. Alan Rotz (car18@psu.edu)

Ph.D., Penn State University, 1977

Adjunct Professor (USDA-ARS Pasture Systems and Watershed Management Research Unit)

Farm production systems; farm environmental impact

Howard M. Salis, (hms17@psu.edu)

Ph.D., University of Minnesota, 2007

Assistant Professor

Synthetic Biology, Genetic compiler, Metabolic Engineering

Robert D. Shannon (rds13@psu.edu)

Ph.D., Indiana University, 1993

Associate Professor

Wetland and aquatic biogeochemistry; pollution of aquatic systems

Paul Smith (pms6@psu.edu)

Professor

Forest (and bio) products marketing — technology-driven product/market development, customer delivered value, international trade show use and effectiveness, bio-energy/fuel supply chains, adoption-diffusion in sustainable education, content analysis of advertising, and Pennsylvania's forest industry

Tamie L. Veith (tlv11@psu.edu)

Ph.D., Virginia Tech, 2002

Adjunct Assistant Professor (USDA-ARS Pasture Systems and Watershed Management Research Unit)

Farm and watershed scale impacts, optimization, water quality