

**LSU Biological &  
Agricultural Engineering  
Graduate Handbook**



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Welcome to the Department of Biological and Agricultural Engineering at Louisiana State University. Your interest in this department is greatly appreciated. Currently the department has over 20 graduate students. Competitive graduate assistantships and fellowships are available to qualified students. We strive to grow and have excellent graduate programs in Bioenvironmental Engineering, Bioprocess Engineering, Biomechanical Engineering, and Physiological engineering. Your contribution in this endeavor is essential and I commend you for accepting the challenge.



The Department of Biological and Agricultural Engineering has exciting research projects in the department in animal waste management engineering, aquacultural engineering, biomedical engineering, composting, water quality, subsurface water management, irrigation, climatology, mechanization of horticultural and vegetable crops, food processing engineering, bio-energy, cellular and molecular engineering, value-added processing, automous vehicles, and sensing. The faculty in the department are directing over fourteen active research projects. Many projects involve interdisciplinary cooperation and are focused on problems facing agricultural producers in Louisiana. Researchers conduct cutting-edge work to address the challenges facing agricultural commodity/clientele groups and recommendations made by the Farm Bureau. Please feel free to contact me if you have any questions or comments. We are on the internet at [www.bae.lsu.edu](http://www.bae.lsu.edu).

Dan Thomas, Ph.D., P.E.  
Head

## Beginning Your Program

You have received letters from the Graduate School and the Department detailing your admission. You should already have been assigned to a faculty advisor. When you have questions, first ask your advisor. You are always welcome to visit with Dr. Mailander, the departmental graduate coordinator.

Your first days can be confusing and exciting. You will need to visit the Main Office in room 149. If you are on an assistantship, our business manager, Ms. Donna Elisar, will have you complete required forms. Clerical assistance is provided by Ms. Rhonda Shepard (research and transportation) and Ms. Angela Singleton (teaching and graduate programs).

You will have been informed of the new graduate student orientation by the Graduate School. Be sure to attend. International students will have also been informed regarding their English language course requirements.

Your advisor will assist you in registering for classes, and discussing possible topics for your research/project. If you are on assistance, you will be assigned an office and provided keys to all the areas you will use. Dr. Thomas will give you a security code and explain the system. Ms. Rhonda Shepard (room 149) will help you obtain the needed keys.

If you need assistance with fabrication of research equipment, contact Mr. Tom McClure in the metals shop. If your research requires transportation, you must enroll in the Defensive Driving course required by the AgCenter, and then check out a vehicle from the main office. Smoking is not permitted in any building at LSU or in vehicles. Seatbelt use is required at all times.

## When you are finished

We hope your time at LSU is enjoyable, but it will come to a conclusion. LSU requires electronic submission of all theses and dissertations. Our department requires both an electronic and a bound paper copy. You should also archive your research data and any publications, and give these to your advisor. In consultation with your advisor; you should disassemble your apparatus, return all instruments/tools/books, and empty your office. Return all keys to Ms. Rhonda Shepard, and allow Dr. Thomas to give you an exit interview.

## Graduate Degree Programs

The BAE Department offers graduate programs at the Master and Ph.D. levels. The department offers a Master of Science in Biological and Agricultural Engineering (MSBAE). We also cooperate with the College of Engineering in offering an interdisciplinary Ph.D. Degree in Engineering Science with Biological and Agricultural Engineering as the major area of study.

The degree program leading to the MSBAE is offered in both thesis and non-thesis options. The thesis option require 30 hours of coursework beyond the bachelor's degree and a publishable thesis. Non-thesis requires 36 hours beyond the bachelor's degree and a project. **The thesis option is required of all students on a graduate research/teaching assistantship.** Eighteen to 22 months is the usual time required for full-time students to complete the MS degree. Three years beyond the Master is the usual time required for completion of the Ph.D. degree.

. A graduate student must assume full responsibility for the knowledge of rules and regulations of the Graduate School and the Department concerning their individual degree program. It is not expected that graduate students require the same degree of guidance as is commonly given to undergraduates.

The MSBAE requires a baccalaureate degree from an ABET accredited engineering program or the equivalent of the required engineering courses. Students pursuing the MSBAE without an engineering background may have to take additional courses to support their program of study, and at least one-half of the graduate coursework must be taken in the College of Engineering.

### MSBAE (thesis)

The focus of the MSBAE is education in engineering research. This program includes a thesis to demonstrate the student's ability to define a problem, survey the literature, and by experimental and/or analytical methods, add to the body of engineering knowledge. The results must be of sufficient significance to be published as a technical paper.

### Graduate Advisory Committee

The program of study will be guided by the student's Graduate Advisory Committee consisting of the major advisor and a minimum of two other members from the LSU Graduate Faculty in the BAE department and/or other

departments related to the student's research area.

### Minimum requirements

24 semester hours of approved graduate coursework, at least 12 of which must be above the 7000 level. At least one advanced mathematics course of 3 credit hours. Enrollment in Graduate Seminar (BE 7500) is required every year with a maximum of 1 credit hour counting towards the graduate degree.

An acceptable thesis must be presented. A minimum of six hours of thesis research credit (BE 8000) is required.

The remainder of the program, including remedial coursework requirements, if any, is left to the discretion of the advisory committee. No more than six hours of BE 7909 is allowed (a seminar presentation of your work to the faculty is required for each instance of BE 7909).

A documented copy of all data collected during the course of the thesis research must be turned into the advisor before graduation.

A final examination is required of all degree candidates.

### MSBAE Chronological Guide (example)

#### Semester 1

- Selection or appointment of major advisor
- 9 hours of coursework and 3 hours of BE 8000
- Selection of Graduate Advisory Committee
- Development of approved Plan of Study
- Identification of Research Topic
- Identification of Research Objectives
- Preparation and presentation of thesis proposal including literature review
- Submission of Plan of Study form and thesis research proposal to the Department

#### Semester 2

- Develop a statistically valid experimental design
- Begin research
- 9 hours of coursework and 3 hours of BE 8000

#### Semester 3

- Conduct research

- Complete analysis of research data
- 3 or 6 hours of coursework and 9 or 6 hours of BE 8000

#### Semester 4

- 12 hours of BE 8000
- Thesis defense

### MSBAE (non-thesis)

The non-thesis option is considered to result in a terminal degree in a technical field. It is appropriate for practicing and/or employed engineers who wish to acquire advanced background and knowledge in chosen subject areas without having the need to pursue rigorous research. The degree can be earned with a part-time program of study. It is generally not available to International students under student visa (F1) category.

#### Minimum requirements

36 semester hours of approved graduate coursework, at least 18 of which must be above the 7000 level. At least one advanced mathematics course of 3 credit hours. Enrollment in Graduate Seminar (BE 7500) is required every year with a maximum of 1 credit hour counting towards the graduate degree. You must declare your intent to join the M.S. non-thesis option before beginning your program of study. If you are in the non-thesis option, you will not be eligible for any financial aid from the university. If you are currently in the thesis option and have received financial support from the department, you will not be permitted to switch to the non-thesis option.

You must complete a three credit project under BE 7909 and present a report approved by your major professor and advisory committee. This report is used in your final exam as a document to portray your ability to do in-depth analysis of a Biological Engineering topic.

The remainder of the program, including remedial coursework requirements, if any, is left to the discretion of the advisory committee. No more than six hours of BE 7909 is allowed (a seminar presentation of your work to the faculty is required for each instance of BE 7909).

A final examination is required of all degree candidates.

### Transfer to Thesis Option

Transfer from non-thesis to the thesis option may be done at any time. However, all of the requirements of the thesis degree program must be met. This includes the appointment of a new advisory committee and possibly a new major professor, the formulation of a new "Plan of Study", and the identification of a research area from which a thesis can be produced. Courses taken in the non-thesis program may be applied to the thesis program only at the discretion of the new advisory committee.

### 3-2 (Accelerated Master's) Program

The 3-2 Program is proposed as a procedure whereby all the required credits for earning B.S. and M.S. degrees in Biological Engineering can be satisfied in 5 years. The primary motivation for the program is to facilitate and encourage our best undergraduate students to pursue a graduate degree in the department.

#### Chronological Guide (example)

#### Junior (3<sup>rd</sup>) Year

##### Semester 6

Student classified as Undergraduate

- Invited to apply, application submitted including Statement of Purpose
- Graduate Advisor selected
- Research Project identified
- Advisory Committee formed
- Plan of Study submitted

#### Senior (4<sup>th</sup>) Year

##### 1<sup>st</sup> Summer

BE 3989 (Special Project) for undergraduate credit on thesis topic.

##### Semester 7

May take 4989 (Independent Study) for graduate credit

Take GRE

Apply for admission to Graduate School

##### Semester 8

Encourage participation in BE 7500 (seminar)

Graduate course (4000/7000)

Graduate (5<sup>th</sup>) Year

**2<sup>nd</sup> Summer**

BE 7909 (Advanced topic)

BE 7909 (Advanced topic)

Math 4999 (Math tune-up) – for credit in the fall semester

**Semester 9**

3 Graduate courses (4000/7000)

BE 8000

**Semester 10**

Graduate course (4000/7000)

BE 7500 (seminar)

BE 8000

## Ph.D. in Engineering Science

The Department of Biological and Agricultural Engineering cooperates with the College of Engineering in offering an Interdisciplinary Doctor of Philosophy degree in Engineering Science with Biological and Agricultural Engineering as the major area of study.

### Qualification for Entering Program

The College of Engineering accepts qualified students with bachelor or master degrees in any of the engineering disciplines to work towards a Ph.D. in an interdisciplinary program. Students with degrees in other scientific disciplines who have completed basic courses in engineering may enter this program and plan curricula with appropriate remedial coursework. The GPA, GRE, and TOEFL scores are the same as for entrance to the other graduate programs.

### General

Each student is required to complete a minimum of 54 semester hours of approved coursework beyond the baccalaureate degree and prepare a dissertation acceptable to their advisory committee and the Graduate School. A mas-

ter's thesis or report credit will not count as part of these hours. Twenty-four of the total semester hours will be concentrated in at least two minor areas. The minor may be in disciplines outside of the College of Engineering. Generally, the minor requirement will be satisfied by two, twelve-hour minors, but any division of hours is permitted as long as a minimum of nine hours is taken in any one subject area.

Courses submitted to satisfy a minor requirement need not be from a single, degree-granting department, but must constitute a coherent and academically sound area of study as certified by the appropriate committee member. No more than half of the remaining thirty hours may be from any one department. Although any academically sound combination of minors and other courses may be taken, at least half of the total (27 hours) coursework must be taken in engineering disciplines.

Enrollment in Graduate Seminar (BE 7500) is required every year with a maximum of 1 credit hour counting towards the graduate degree, an advanced math class must be included in the program of study. No more than six hours of credit in BE 7909 will be accepted (a seminar presentation of your work to the faculty is required for each instance of BE 7909).

### Graduate Advisory Committee

Each student must plan a course of study with a major professor from the BAE department. The program must be approved by an advisory committee consisting of at least five but not more than six members (including the major professor) of the graduate faculty approved by the Dean of the College of Engineering and by the Dean of the Graduate School. Three members of the student's committee must be members of the Graduate Faculty from the College of Engineering—two of which must be full members of the graduate faculty. At least two members must come from departments within the University offering the Ph.D. degree. A committee member must represent each minor field.

### Qualifying Examination

A plan of study, including a proposal for research feasible in a university environment and a list of proposed coursework approved by the Dean of the Graduate school replaces the qualifying examination. This requirement

must be satisfied prior to registration for the second semester of graduate study if the student already has a Master degree. Students entering the Ph.D. program directly from the BS level may wait until the second semester of their program to fulfill the qualifying requirement.

### **General Examination**

The doctoral candidate must satisfactorily pass a thorough and rigorous General Examination at least one year before completion of the dissertation. This examination will be conducted by the student's advisory committee plus one outside Graduate Faculty Member appointed by the Dean of the Graduate School. The form of the examination may be written, oral or both. The General Examination is open to the university faculty. Any member of the faculty may submit questions. The opinion of faculty members who are not members of the student's examining committee may or may not be taken into account by the committee. The vote on passing is limited to members of the examining committee only. The General Examination is not just a defense of the research proposal, but a broad-based examination of the knowledge of the candidate.

### **Dissertation**

An acceptable dissertation containing material of publishable quality must be presented and successfully defended at the Final Examination as described in the LSU Graduate Catalog.

A documented copy of all data collected during the course of the dissertation research must be turned into the advisor before graduation.

### **Doctor of Philosophy Chronological Guide**

#### **Semester 1**

- Selection or appointment of major advisor
- Selection of Advisory Committee
- Development of Plan of Study (final approval by student's graduate advisory committee)

- Identification of research topic
- 9 or 12 hours of coursework and 3 hours of thesis research

#### **Semester 2**

- Submission of Graduate School Plan of Study and Advisory Committee Forms
- Identification of research objectives
- 9 or 12 hours coursework and 3 hours of research

#### **Semester 3**

- Preparation of Thesis Proposal including literature review
- Develop statistically valid experimental design and conduct research
- 9 hours of course work and 3 hours of research

#### **Semester 4**

- Complete General Examination
- Conduct research
- 12 hours of research

#### **Semester 5**

- Complete analysis of research data
- Prepare draft of thesis
- 12 hours of research

#### **Semester 6**

- Final examination (dissertation defense)
- 12 hours of thesis
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### **Ph.D. in Engineering Science Degree Requirement Checklist**

- Baccalaureate or Masters degree in any field of engineering or a pure or applied science
- Concentration of study in a major area and two minor areas
- Advisory committee of at least five members of the Graduate Faculty, including the major professor (who is Chairman).
  - Includes two Full Members of the Graduate Faculty
  - Chairman of Full or Associate Member of Graduate Faculty
  - At least three members are from departments offering the Ph.D. degree
  - Both minor areas of study are represented

- 54 hours of graduate-level coursework
  - Distribution by college
    - At least 27 hours in courses offered by departments in the College of Engineering (or equivalent departments for transfer credit)
    - Remaining ( $\leq 27$ ) hours chosen from graduate-level courses in any College or School

#### Distribution by areas of concentration

- Remaining 30 hours concentrated in major areas of study, with no more than 15 of these hours in any single departmental discipline, either within or outside the College of Engineering (e.g., Mechanical Engineering, Environmental Studies, Nuclear Science, Mathematics, etc.), including transfer credit
- Program of study completed during first semester in program
- General examination administered by the Advisory Committee
- Final examination (dissertation defense) administered by Advisory Committee

### Assistantships

Research and teaching assistantships are available to qualified students on a competitive basis. Graduate assistants on full-time assistantships are exempt from tuition but must pay fees, which may be paid through payroll deduction. A "full-time" graduate student is one who is fully committed to graduate study and who devotes no appreciable time to any duties not directly related to his graduate work. Full-time status does not depend solely on the number of hours for which a student registers, although it is normally required that a full-time graduate student will take a least nine semester hours of work (six in the summer). Graduate assistants are considered full-time students and are expected to register for a full load of graduate courses each semester until all degree requirements are completed. International students must maintain a full-time status to keep a valid visa.

Graduate degree candidates in good standing are eligible for financial assistance. The candidate's commitment in return for financial assistance is one-half time in service and research on approved departmental projects. In selected cases, teaching responsibilities may be assigned. Students on departmental assistantship are not allowed to enroll in a dual-degree program.

### Student Life

Many students take advantage of the cultural and recreational activities that make LSU so rich. These include concerts and theater both on and off-campus, and the opportunities available at the Student Recreational Center, through intramural sports, and as fans at the many activities of the LSU athletic department. Students are encouraged to have an active life outside the classroom and laboratory. Baton Rouge and south Louisiana also have many opportunities for experiencing the culture of a unique part of this country.

### Research Laboratories

In addition to modern, well-equipped teaching and research laboratories, the department has a complete research fabrication shop with expert technical staff. For field research work, you will have access to major farm equipment and to the 17 Louisiana Agricultural Experiment Stations located throughout the state. Cooperative research with CAMD and Pennington Biomedical Center is available.

#### Aquaculture Lab

Research on water quality in recirculating systems plus other aspects of seafood production is carried on in two laboratory buildings (containing 26,000 square feet) and 130 ponds covering more than 40 water surface acres.

#### BioMEMS and Biophotonics Lab

Well equipped with molecular biology, microscopy, and cell culture instrumentation to study engineering processes at the cellular and molecular level.

#### Callegari Environmental Center

The 8-acre facility includes an 8,500 square foot building that houses the Organic Degradation Research Laboratory, Next to the building is a 3-acre composting pad.

#### Muscle-Foods Processing Lab

Pilot-scale facility equipped for work in new food product development and for exploration of novel food processing technologies.

### **Nanoparticle and colloidal systems laboratory**

The laboratory is well equipped for synthesis and characterization of nano- and colloidal systems designed for targeted delivery of bioactive components (i.e. vitamins, antioxidants, colorants).

### **Renewable Energy Lab**

Well-equipped for biomass conversion research with reactors, gasifiers and analytical equipment.

### **Rice Milling and Value-added Lab**

A pilot-scale mill with individual units for cleaning, shelling, milling, and grading rice and special equipment for rice bran extrusion, stabilization, and bran oil extraction (solvent, supercritical, and microwave).

### **Sensor Lab**

Contains GIS, GPS and image analysis equipment for precision farming applications and sensors for yield monitoring of cotton, sugarcane, and other crops.

### **Water Quality Lab**

This research laboratory contains analytical equipment needed to perform gravimetric, potentiometric, colorimetric and microbial analysis of water and wastewater samples.

### **Research Faculty Interests**

*Richard L. Bengtson*, P.E. \* Professor - Ph.D., Oklahoma State University, 1980 \* Soil erosion, hydrology, crop response to excess water stress and water management, surface and ground water quality.

*Roberto Barbosa* \* Assistant Professor - Ph.D., University of Tennessee, 2005 \* Application of crop protectants, amendments and fertilizers, including drift minimization, variable-rate application and precision farming technology.

*Dorin Boldor* \* Assistant Professor - Ph.D., North Carolina State University, 2003 \* Microwave heating, bioprocessing.

*Steven G. Hall*, P.E. \* Associate Professor - Ph.D., Cornell University, 1998 \* Aquacultural engineering and composting.

*Daniel Hayes*, \* Assistant Professor - Ph.D., The Pennsylvania State University, 2004 \* micro- and nano-scale fabrication and nanoscale influences on biological processes.

*Marybeth Lima*, P.E. \* Professor - Ph.D., Ohio State University, 1996 \* Food and bio-process engineering, rice processing, playground design, and engineering education.

*Michael P. Mailander* \* Associate Professor - Ph.D., Purdue University, 1985 \* Sensing, precision farming, automatic controls, bioenergy.

*W. Todd Monroe*, P.E. \* Assistant Professor - Ph.D., Vanderbilt University, 2001 \* Biomedical, BioMEMS, biophotonics, cellular and molecular engineering.

*Keith Morris* \* Assistant Professor - Purdue University, 2004 \* Spatial Technologies (GPS, GIS and remote sensing) as it pertains to precision agriculture.

*Cristina Sabliov* \* Assistant Professor - Ph.D., North Carolina State University, 2003 \* Bio-processing, microwave heating, mathematical modeling, separation methods, nanotechnology.

*Chandra Theegala* \* Assistant Professor - Ph.D., Louisiana State University, 1999 \* Agricultural byproduct & waste treatment/management, biosensors, bioenergy & alternative energy.

*Daniel L. Thomas*, P.E. \* Professor and Head - Ph.D., Purdue University, 1984 \* Water resources engineering, irrigation, water quality impacts of agricultural systems, hydrology, and precision systems.

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