

Graduate Handbook

for

Degrees in Biosystems Engineering

Michigan State University
Department of Biosystems and Agricultural Engineering

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1. Program Overview

Biosystems engineers apply the basic sciences, mathematics, engineering sciences, and technology to design sustainable solutions to problems with a critical biological component. Biosystems engineers work to ensure an adequate and safe food supply while efficiently utilizing natural resources and protecting the environment. Specific application areas include food and biomass production systems, food processing systems, processing systems for utilization and conversion of biological products, water and waste management systems, natural resource and environmental protection, biosensing and a range of other biological challenges that require engineering expertise. Biosystems Engineers work at the crossroads of engineering and biology and integrate such for systems-based solutions. The department offers both Master of Science and Doctor of Philosophy degree programs with majors in Biosystems Engineering. The Biosystems and Agricultural Engineering Department and its graduate programs are administered by the College of Agriculture and Natural Resources but share programming with the College of Engineering. Advanced degree Biosystems Engineers, with their broad understanding of engineering and biology, find employment in academia, leadership in state and federal divisions, advanced levels of management and research and development in food and other companies, and various other positions where having the broad knowledge to apply a systems approach is vital.

The purpose of the **Master of Science (M.Sc.)** program in Biosystems Engineering is to prepare graduates for advanced career opportunities that require disciplinary expertise beyond that available in the Bachelor of Science degree. Specifically, the Plan A (thesis option) program introduces the student to research methods, and the student is expected to execute, analyze, and publish an original research project under the close guidance of the major advisor. In contrast, the Plan B (non-thesis option) program is suited for those who do not plan a research-related career, but desire additional skills and knowledge obtained through advanced coursework. Most students complete Plan A programs and the A or B option is determined by consultation between the major professor and the student at time of application.

The purpose of the **Doctor of Philosophy (Ph.D.)** program in Biosystems Engineering is to prepare graduates for advanced careers that require demonstrated research skills and comprehensive knowledge of the discipline. Therefore, the program is suitable only for those students who have demonstrated outstanding ability and potential in the field, either by high quality work in an M.Sc. degree or by exceptional achievement in a B.S. degree with additional technical and professional accomplishments. The student is expected to demonstrate in-depth and comprehensive knowledge of the discipline and skills in disseminating that knowledge through teaching and/or training experiences. Additionally, the student must demonstrate the ability to plan, conduct, manage, and publish independent, original research, via the dissertation and peer-reviewed manuscripts.

2. Program Components and Roadmap to Your Degree

2.1. Master of Science Degree

The typical path for the Master of Science degree in Biosystems Engineering is as follows.

- Plan A (with thesis) option that is most often selected/available.

- Gain admission to the program. Your major professor is determined as part of the application process as all graduate opportunities are based with individual faculty.
- Develop a plan of study with your major advisor.
- Complete the required course work (at least 22-24 course credits and 6-8 research credits) and your thesis research.
- Defend your thesis in an oral examination. Most students finish the program within two years.

- Plan B (courses with project) option, not generally granted under internally funded programming.

- Gain admission to the program. Your major professor is determined as part of the application process as all graduate opportunities are based with individual faculty.
- Develop a plan of study with your major advisor.
- Complete the required course work (30 course credits and a project and project report).
- Complete a final project presentation and guidance committee administered exam.

2.2. Doctor of Philosophy

The typical path for the Doctor of Philosophy degree in Biosystems Engineering is as follows.

- Gain admission to the program. Your major professor is determined as part of the application process as all graduate opportunities are based with individual faculty.
- Develop a plan of study with your guidance committee before the end of your second semester. Your major advisor is normally the chairperson of the guidance committee.
- Pass your oral and written components of your comprehensive examination.
- Submit two papers to refereed journals.
- Complete your dissertation research, write your dissertation, and defend it in an oral examination. Most students finish the program within four years.

2.3. English Language Proficiency

TOEFL scores are required for all international applicants. The University requires all international applicants to submit their scores from the TOEFL Exam to the English Language Center at Michigan State University: <http://elc.msu.edu/>. Applicants must receive the following minimum scores: a) Internet-based test: score of 80 with no subscore below 19 for reading, listening and speaking; and no subscore below 22 for writing; or b) Paper-based test: score of 550 with no subscore below 52; or c) Computer-based test: score of 213 with no subscore below 19. The Biosystems Engineering Program does not admit students who do not meet these minimum standards.

MSU candidates for TA appointments who were required to demonstrate English proficiency as a condition for regular admission to Michigan State University must also demonstrate that they meet a minimum standard of proficiency in spoken English before they can be assigned teaching work that involves oral communication with undergraduate students.

Those international teaching assistants (ITAs) may meet this requirement in one of the following ways:

- Presenting a TOEFL iBT speaking section score of 27 or higher.
- Receiving a score of 50 or higher on the MSU Speaking Test.
- Taking AAE 451 or AAE 452 (ITA language support courses) and receiving a score of 50 or higher on the ITA Oral Interaction Test (ITAOI).

Those ITAs who received a waiver of the TOEFL or of other accepted tests of English proficiency for admission, must also meet the requirement of proficiency in spoken English before they are assigned to teaching work that involves oral communication with undergraduate students. To meet this requirement, those ITAs may use any of three options listed above. Individual exceptions from these requirements (on a case-by-case basis in rare circumstances) will be considered by the Graduate School in consultation with the ELC upon the request of the department and with the endorsement of the Associate Dean of the College.

3. Degree Requirements in Biosystems Engineering

(Note: all necessary forms not conducted electronically via Grad Plan can be found on D2L-BE Graduate Studies)

3.1. Master of Science

3.1.1. Admission

To be considered for admission to the Master of Science degree program in Biosystems Engineering, an applicant must take the Graduate Record Examination (General Test) and have the scores sent to the department.

3.1.1.1. Regular Status

Admission to the master's degree program in Biosystems Engineering with regular status may be granted by the department, subject to the availability of resources and the approval of the dean, upon consideration of the likelihood that the applicant will be able to complete a master's degree program successfully. To be admitted to the master's program in Biosystems Engineering, an applicant must have:

- A grade-point average not lower than 3.00 for the final two years of the undergraduate program, or standing in the upper quarter of the graduate

class in the student's major.

- A bachelor's degree, either:
 - from an accredited program in engineering, or
 - from a related science-oriented program in which the applicant has shown very high academic achievement, as certified by the department. In particular, an applicant without an engineering degree must demonstrate the abilities and experience necessary to succeed in the core courses (BE 815 and 835) and succeed in the anticipated graduate program.

3.1.1.2.Provisional Status

Admission to the master's degree program in Biosystems Engineering with provisional status may be granted by the department, subject to the approval of the dean:

- To an applicant qualified for regular admission, except that collateral courses (background courses) are deemed necessary such that the student will graduate with core knowledge in subjects expected of any individual possessing a Biosystems Engineering degree at any level. This core knowledge is primarily represented by the 300 level courses required in the Biosystems Engineering undergraduate program, or
- To an applicant whose record is incomplete.

If collateral courses are required, the minimum acceptable grades and the semesters by which those courses must be completed will be specified at the time of admission. Biosystems Engineering 490 and 890 (Independent Study) may *not* be used to satisfy collateral course requirements. The provisional status will be changed to regular status when the conditions specified during admission have been met, as certified by the department and approved by the dean.

3.1.1.3.Linked Bachelor's-Master's Degree and Dual Enrollment for BS+MS Degree in Biosystems Engineering

The department welcomes applications from Michigan State University Biosystems Engineering undergraduate students in their junior and senior year. Admission applications must be made during the prior Spring semester for an anticipated Spring graduation or the prior Fall semester for an anticipated Fall graduation to allow admission before the final semester as a Biosystems Engineering undergraduate. Admission to the program requires a minimum undergraduate grade-point average of 3.50 and an approved program of study for the Master of Science degree in Biosystems Engineering at the time of admission. Admission to the Linked Bachelor's-Master's Program allows the application of up to 9 credits toward the master's program for qualifying 400-level and above course work taken at the undergraduate level at Michigan State University or an external accredited institution. The number of approved credits, not to exceed 9, are applied toward the credit requirement of the master's degree. Credits applied to the Linked Bachelor's-

Master's Program are not eligible to be applied to any other graduate degree program.

An alternative program that is becoming more common is the Dual Enrollment for BS+MS Degree. This program is similar to the linked program except entrance requirements are less stringent and students do not need to apply and be accepted 1.5 semester before graduating. More details on both programs can be found at <https://www.egr.msu.edu/graduate/dual-enrollment-and-linked-bsms-degree-options>.

3.1.2. Program Filing

The student's program of study (coursework) must be approved before the student completes 6 credits of graduate work for the student to continue to enroll in the master's degree program. The subject matter and instructor must be specified for every independent study, special problem, or selected topics course that is included in the student's approved program of study.

After the Plan A or Plan B option has been agreed upon by the major professor and the student, the student may not pursue the other option without approval of the department.

The following changes are not permitted in a student's approved program of study:

- Adding or deleting a course for which a grade has already been assigned under any of the three grading systems (Numerical, Pass-No Grade, or Credit-No Credit).
- Adding or deleting a course for which grading was postponed by the use of the DF-Deferred marker.
- Adding or deleting a course which the student dropped after the middle of the semester and for which "W" or "N" or "0.0" was designated.
- Adding or deleting a course during the final semester of enrollment in the master's degree program.

3.1.3. Requirements for the Master of Science Degree

The program is available under both Plan A (with thesis) and Plan B (without thesis). The student's program of study is developed in consultation with the major professor and must be approved by the student's guidance committee and the department.

3.1.3.1. Requirements for Both Plan A and Plan B

The BAE department is jointly administered by the College of Agriculture and Natural Resources and the College of Engineering. For the graduate program, the student must meet the requirements specified below in addition to the requirements of the University and the College of Agriculture and Natural Resources.

1. Complete a minimum of 30 credits in 400 or higher-level courses. At least 20 of the 30 credits must be at the 800-900 level.

2. Complete one course in statistics at MSU at the 400 level or above. Courses used to meet the B.S. requirements cannot be used to satisfy this requirement. An approved list of courses will be maintained by the department.
3. Complete all of the following courses:

BE	815	Experimentation and Instrumentation in Biosystems Engineering
BE	820	Research Methods in Biosystems Engineering
BE	835	Modeling Methods in Biosystems Engineering
BE	892	Biosystems Engineering Seminar

3.1.3.2. Additional Requirements for Plan A

The student must:

1. Complete at least 6 (and no more than 8) credits of the 30-credit total requirement with BE 899 (Master's Thesis Research) credits.
2. Pass a final oral examination over, and in defense of, the written thesis. The final examination is administered by the Department and conducted by the student's guidance committee.
3. Submit at least one paper to a refereed journal before scheduling the oral examination in defense of the thesis. The student must be the primary author, and the manuscript must be based on work completed during the Master's program. The guidance committee will recommend a list of appropriate refereed journals. Requirements under this item can be waived under extraordinary circumstances at the request of the advisor or guidance committee and approval by the graduate director and department chairperson.
4. Provide to the major professor and to the department an electronic copy of the thesis approved by ProQuest.

Note: Not more than 4 credits of BE 890 may be counted toward the requirements for the degree under Plan A.

3.1.3.3. Additional Requirements for Plan B

The student must:

1. Carry out a project and pass the final examination administered by the student's guidance committee over the course work in the student's approved program of study.
2. The examination must include both a written and an oral component. The examination structure and expectations will be conveyed, by the student's guidance committee or major professor, to the student prior to the examination.
3. A formal report of the Plan B project is required.

Note: Not more than 6 credits of Biosystems Engineering 890 may be counted toward the requirements for the degree under Plan B.

3.1.4. Academic Standards

- *Grades.* The student must earn a grade of 2.0 or higher in each course in the approved program of study. The student must repeat any course in the approved program for which the grade earned was below 2.0.
- *Cumulative Grade-Point Average.* The student must maintain a cumulative grade-point average of at least 3.00 in the courses in the approved program of study.
- *Probational Status.* A student is placed on probational status if the student's cumulative grade-point average for the courses in the approved program of study is below 3.00. A student in probational status is not allowed to carry more than 7 credits per semester or to enroll in any course the primary focus of which is independent study.
- *Retention In and Dismissal from the Program.*
 - *Cumulative Grade-Point Average.* Should a student's cumulative grade-point average fall below 3.00 after having completed 16 or more credits in courses in the approved program of study, the student may be enrolled in probational status in the master's degree program for one additional semester. If at the end of the additional semester the student's cumulative grade-point average is 3.00 or higher, the student may continue to enroll in the master's degree program. If at the end of the additional semester the student's cumulative grade-point average is still below a 3.00, the student will be dismissed from the program.
 - *Academic Progress and Performance.* Each student's academic progress and performance toward the completion of their degree program is reported and evaluated each year. Students must be making adequate progress in the completion of required courses; and M.Sc. (Plan A) students must be making adequate progress in the research required to complete their degree. A student who is not making satisfactory academic progress or appears to lack the potential to complete the program will be placed on academic probation. Students on probation will be dismissed if academic progress and performance do not improve. The overall evaluation process is described in Section 7.

3.1.5. Continuation from M.Sc. to Ph.D. Program

Plan A students who complete the M.Sc. degree in BE at MSU and are favorably recommended by the M.Sc. guidance committee to continue for Ph.D. studies should complete the "Request to Continue for a Ph.D. in Biosystems Engineering" form obtained from the Graduate Secretary. Students who complete the M.Sc. degree in BE at MSU and who are not recommended for Ph.D. studies by the M.Sc. guidance committee must reactivate their file to be considered for admission into the Ph.D. program. Their file will be considered as part of the regular review process conducted by the department.

Plan B students may submit an application to the department for acceptance into the Ph.D. program following the standard application procedures and timelines.

3.2. Doctor of Philosophy

3.2.1. Admission

To be considered for admission to the Doctor of Philosophy degree program in Biosystems Engineering, an applicant must take the Graduate Record Examination (General Test) and have the scores sent to the department.

3.2.1.1.Regular Status

Admission to the doctoral degree program with regular status may be granted by the department, subject to the availability of resources, and upon consideration of the likelihood that the applicant will be able to complete a doctoral program successfully.

To be admitted to the doctoral program in Biosystems Engineering, an applicant should have a master's degree and must:

- Have either a Bachelor of Science degree in engineering or a master's degree in engineering
- Demonstrate evidence of ability and resolution to complete a doctoral program, as attested by the department upon review of the applicant's academic record, test scores, experience, reference statements, professional qualifications, proposed studies, and other relevant information.

Admission to the doctoral program without a master's degree, or the equivalent thereof, requires special approval by the department.

3.2.1.2.Provisional Status

Admission to the doctoral degree program in Biosystems Engineering with provisional status may be granted by the department, subject to the approval of the Dean:

- To an applicant qualified for regular admission, except that collateral courses (background courses) are deemed necessary such that the student will graduate with core knowledge in subjects expected of any individual possessing a Biosystems Engineering Degree at any level. This core knowledge is primarily represented by the 300 level courses required in the Biosystems Engineering undergraduate program, or
- To an applicant whose record is incomplete.

A student who is admitted to the Doctor of Philosophy degree program without a Master of Science degree in engineering or without the equivalence of core Biosystems Engineering coursework may be required to complete collateral courses, in addition to the courses that are required for the doctoral degree. If collateral courses are required,

the minimum acceptable grades and the semesters by which those courses must be completed will be specified at time of admission. Biosystems Engineering 490 and 890 may *not* be used to satisfy collateral course requirements. The provisional status will be changed to regular status when the conditions specified on the admission form have been met, as certified by the department and approved by the dean.

3.2.2. Program of Study (Coursework)

The student's program of study (coursework) shall be submitted for approval to the Department of Biosystems and Agricultural Engineering and to the dean through GradPlan by no later than the end of the student's second semester of enrollment in the doctoral program. The subject matter and instructor must be specified for every independent study, special problems, or selected topics course that is included in the student's approved program of study.

The student's program of study must be approved for the student to continue to enroll in the doctoral degree program beyond the second semester.

3.2.3. Modification of the Program

The following changes are not permitted in a student's approved program of study:

- Adding or deleting a course for which a grade has already been assigned under any of the three grading systems (Numerical, Pass-No Grade, or Credit-No Credit).
- Adding or deleting a course for which grading was postponed by the use of the DF-Deferred marker.
- Adding or deleting a course which the student dropped after the middle of the semester and for which "W" or "N" or "0.0" was designated.
- Adding or deleting a course during the final semester of enrollment in the doctoral degree program.

3.2.4. Requirements for the Doctor of Philosophy Degree

The BAE department is jointly administered by the College of Agriculture and Natural Resources and the College of Engineering. For the graduate program, the student must meet the requirements of the University, the College of Agriculture and Natural Resources, and the 11 requirements below:

1. Complete a minimum of 38 additional course credits (excluding BE 899 or BE 999) past the B.S. degree, at the 400 or higher level. The specific courses that a student is required to complete will depend on prior academic background in relation to the selected area of study and research. These 38 credits must be approved by the student's guidance committee, and must include (unless previously taken) the following: BE 815, BE 820, BE 835, and BE 892.

2. Complete one course in a biological science at MSU at the 400 level or above. The courses applied to the B.S. program cannot be used to satisfy this requirement. An approved list of courses will be maintained by the department.
3. Complete one course in quantitative analysis or mathematics at MSU at the 400 level or above. The courses applied to the B.S. program cannot be used to satisfy this requirement. An approved list of courses will be maintained by the department.
4. Complete one course in statistics at MSU at the 800 level or above. The courses applied to the B.S. program cannot be used to satisfy this requirement. An approved list of courses will be maintained by the department.
5. Complete all of the following courses (unless previously taken):
 - BE 815 Experimentation and Instrumentation in Biosystems Engineering
 - BE 820 Research Methods in Biosystems Engineering
 - BE 835 Modeling Methods in Biosystems Engineering
 - BE 892
 - Biosystems Engineering Seminar
6. Complete a minimum of 24 credits of BE 999 (Doctoral Dissertation Research). Students may not exceed 36 credits of BE 999.
7. Pass the doctoral qualifying examination.
8. Pass the doctoral comprehensive examination within five years of the date of first course enrollment that counts to the student's program of study and at least six months prior to the final oral examination in defense of the dissertation. The examination may be retaken once.
9. Submit at least two papers to refereed journals before scheduling the oral examination in defense of the dissertation. The student must be the primary author, and the manuscripts must be based on work completed during the Ph.D. program. The guidance committee will recommend a list of appropriate refereed journals. Requirements under this item can be waived under extraordinary circumstances at the request of the advisor or guidance committee and approval by the graduate director and department chairperson.
10. Pass the examination in defense of the dissertation. The examination may be retaken once.
11. Provide to the major professor, and to the department an electronic copy of the dissertation approved by ProQuest.

3.2.5. Academic Standards

- Grades. The student must earn a grade of 2.0 or higher in each course in the approved graduate plan, including collateral courses and courses accepted in transfer. The student must repeat any course on the approved program for which the grade earned was below 2.0.
- Cumulative Grade-Point Average. The student must maintain a cumulative grade-

point average of at least 3.00 in courses in the approved graduate plan, with the exception of collateral courses and courses accepted in transfer.

- Deferred Grades. A student may accumulate no more than three deferred grades (identified by the DF-Deferred marker) in courses other than those courses the primary focus of which is independent study.
- Probational Status. A student is placed on probational status if either or both of the following conditions apply:
 - The student's cumulative grade-point average for the courses in the approved graduate plan is below 3.00.
 - The student has accumulated more than three deferred grades (identified by the DF-Deferred marker) in courses other than those courses the primary focus of which is independent study.
 - A student on probational status is not allowed to carry more than 7 credits per semester or to enroll in any course the primary focus of which is independent study.
- Retention in and Dismissal from the Program.
 - Cumulative Grade-Point Average. Should a student's cumulative grade-point average fall below 3.00 after having completed half of the courses in the approved graduate plan, the student may be enrolled in probational status in the doctoral degree program for one additional semester. If at the end of the additional semester the student's cumulative grade-point average is 3.00 or higher, the student may continue to enroll in the doctoral degree program. If at the end of the additional semester the student's cumulative grade-point average is still below 3.00, the student will be dismissed from the program.
 - Deferred Grades. Should a student accumulate more than three deferred grades (identified by the DF-Deferred mark) in courses other than independent study, the student may be enrolled on probational status for one additional semester. If at the end of the additional semester the student has no more than three deferred grades, the student may continue to enroll. If at the end of the additional semester the student still has more than three deferred grades, the student will be dismissed from the program.
 - *Academic Progress and Performance*. Each student's academic progress and performance toward the completion of their degree program is reported and evaluated each year (see Appendix). Students must be making adequate progress in the completion of required courses, and in the research required to complete the Ph.D. degree. A student who is not making satisfactory academic progress or appears to lack the potential to complete the program will be placed on academic probation. Students on probation will be dismissed if academic progress and performance do not improve. The overall evaluation process is described in Sec. 7.

4. Selection of the Thesis/Dissertation Advisor

Students may request a specific faculty advisor within their academic statement when applying for a degree program. It is also recommended that students/applicants directly contact faculty within their domain of interest prior to formally applying to determine whether opportunities and funding are available and to gauge whether the student could be a strong applicant for any available openings. Advisors are determined as part of the admission process as all graduate opportunities are based with individual faculty. After admission to the program, a request for a change of major professor must be made, in writing, to the department chairperson.

5. Formation of the Guidance Committee

The student's M.Sc. guidance committee consisting of at least three regular university faculty members, one of which can be a Graduate School approved external guidance committee member and at least two of which must be Biosystems Engineering faculty and one of these two may be a Department of Biosystems and Agricultural Engineering adjunct faculty approved by the BAE faculty for service on guidance committees as a Biosystems Engineering faculty.

The student's Ph.D. guidance committee consists of at least four regular faculty members, one of which can be a Graduate School approved external guidance committee member, and is appointed by the department chairperson in consultation with the student and the appropriate faculty members, and with the approval of the dean. At least two members of the guidance committee shall be from the Department of Biosystems and Agricultural Engineering (One of these two may be a Department of Biosystems and Ag. Engineering adjunct faculty approved by the BAE faculty for service on guidance committees as a Biosystems Engineering faculty), and at least one member shall be from a different department, preferably from either the College of Engineering or the College of Agriculture and Natural Resources. The chairperson of the guidance committee is generally the major advisor/major.

6. Thesis/Dissertation Defense (Final Oral Exam) and Comprehensive Examination

6.1. Master of Science Final Oral Exam/Thesis Defense

All Master's students (Plan A) are required to pass a Final Oral Exam covering, and in defense of, their thesis topic. The student's guidance committee administers this examination. The following items constrain the Final Oral Exam/Defense:

- The student must be enrolled during the semester in which the exam is taken. All students defending their thesis in the summer need to be registered for at least one credit during that summer, regardless of their being enrolled in the preceding spring semester.
- Doctoral students will need to have met the requirement for six (6) hours of discussion-based RCR training before they reach candidate status (i.e., have passed their comprehensive exam).
- The student must provide each of the guidance committee members with a copy of the thesis at least 2 weeks prior to the exam.
- The student must schedule a time for the exam and a conference room at least 2

weeks prior to the exam.

- The student must give the Graduate Secretary at least 2 weeks' notice of the exam so that an announcement may be posted for others that may want to attend.

6.2. Submission of Master's Thesis (Plan A)

After a M.Sc. student has passed the final oral exam/defense, the next step is typically revising/completing the thesis. After the thesis has been approved by the student's committee it should be finalized in the layout specified by the MSU Graduate School. Students should obtain a copy of the "Formatting Guide for Masters Theses and Doctoral Dissertations" from the Graduate School: (<https://grad.msu.edu/etd/formatting-guide>) for details on the layout of the thesis. The M.Sc. thesis must be written using SI (metric) units. The thesis is formally submitted to the Graduate School through ProQuest.

Note: In addition, students submitting a thesis to ProQuest can request a hold/embargo of publication by ProQuest by contacting the Graduate School at msuetds.approval@grd.msu.edu or calling (517) 353-3220. In response to the request, the Graduate School will send directly to the student a form that needs to be completed and turned to the Graduate School prior to the document submission to ProQuest. The form needs to be signed by the student's major professor and by the Associate Dean of the student's college. The request for the hold/embargo may be for six months, one year or two years. Requests for a period longer than six months must include a brief justification for the length of the requested hold/embargo.

6.3. Ph.D. Comprehensive Exam

When the prescribed course work is substantially complete as defined by the guidance committee, the doctoral student is eligible to take the comprehensive examination covering the major and related fields. At least one component of the comprehensive examination must be written. Students must be registered during the semester(s) in which they take comprehensive examinations with the exception of during a summer semester in which they are registered either the preceding spring semester or the following fall semester.

The comprehensive examination is initiated, and organized, by the student's major professor and conducted by the guidance committee. All guidance committee members will submit questions as part of the written examination, which must cover the disciplinary breadth and depth necessary to complete a Ph.D. in Biosystems Engineering. The written portion of the comprehensive exam serves as the qualifying examination in Biosystems Engineering. A positive vote by the majority of the guidance committee is required to pass the written exam. The written exam may be retaken once. Students failing on the second attempt are dismissed from the program.

At an appropriate time, following completion of the written questions, a meeting of the guidance committee will be scheduled for the purpose of completing the oral phase of the comprehensive examination. The student must prepare a detailed written dissertation research proposal (including an extensive literature review of the research topic), and deliver it to the guidance committee at least two weeks prior to the exam. This proposal provides the basis for

the oral examination. The oral exam may be retaken once. Students failing on the second attempt are dismissed from the program.

The comprehensive examination must be passed within five years and all remaining requirements for the degree must be completed within eight years from the time of a student's first enrollment as a doctoral student. Should the degree requirements not be completed within this eight-year period, the doctoral comprehensive examination must be passed again.

Full time status for doctoral students is defined as a minimum of 1 credit for those students who: a) Have successfully completed the comprehensive examination and are actively engaged in dissertation research: or b) Are doing department-approved off-campus fieldwork related to preparation of their dissertation. (Note, this is separate from full time status considered, or required as, part of one's visa)

6.4. Defense of Doctoral Dissertation (Final Oral Exam)

The defense of the dissertation is conducted and evaluated by the guidance committee. Other interested faculty members may attend the examination, but not vote. The defense of the dissertation must be scheduled for a date not earlier than two weeks after the dissertation and abstract have been submitted to the chairperson of the guidance committee, other guidance committee members, and any appointed examiner. The following items constrain the Final Oral Exam/Defense:

- The student should be enrolled during the semester in which the exam is taken. All students defending their dissertation in the summer need to be registered for at least one credit during that summer, regardless of their being enrolled in the preceding spring semester.
- The student must provide each of their committee members with a copy of the dissertation at least 2 weeks prior to the exam.
- The student must schedule a time for the exam and a conference room at least 2 weeks prior to the exam.
- The student must give the Graduate Secretary at least 2 weeks' notice of the exam so that an announcement may be posted for others that may want to attend.

6.5. Submission of Doctoral Dissertation

After a Ph.D. student has passed the oral exam, the next step is typically revising/completing the dissertation. After the dissertation has been approved by the student's guidance committee it should be finalized in the layout specified by the MSU Graduate School. Students should obtain a copy of the "Formatting Guide for Masters Theses and Doctoral Dissertations" from the Graduate School: (<https://grad.msu.edu/etd/formatting-guide>) for details on the layout of the dissertation. The Ph.D. Dissertation must be written using SI (metric) units. The thesis is formally submitted to the Graduate School through ProQuest.

The dissertation must be approved by the last day of final exams week to receive your degree that semester.

Note: the MSU publishing agreement for dissertations with ProQuest provides an “Open Access Publishing Option”. The Open Access option gives ProQuest the authorization to make the electronic version of the document accessible to all via the internet, including the selling of the document by commercial retailers and the accessibility to the work via search engines. A student selecting the Open Access option will not be eligible to receive royalties.

In addition, students submitting a dissertation to ProQuest can request a hold/embargo of publication by ProQuest by contacting the Graduate School at msuetds.approval@grd.msu.edu or calling 517 353 3220. In response to the request, the Graduate School will send directly to the student a form that needs to be completed and turned to the Graduate School prior to the document submission to ProQuest. The form needs to be signed by the student’s major professor and by the Associate Dean of the student’s college. The request for the hold/embargo may be for six months, one year or two years. Requests for a period longer than six months must include a brief justification for the length of the requested hold/embargo.

6.6 Creating an Open Researcher and Contributor ID (ORCID)

At the time of submission to ProQuest, authors now have the opportunity to create an ORCID that provides researchers with a unique identifier for linking their research outputs and activities. An ORCID:

- Improves recognition of research contributions
- Reduces form-filling (enter data once, re-use it often)
- Works with many institutions, funders, and publishers
- Is a requirement of many journal manuscript submission systems and grant application forms.

To learn more about ORCID go to: <https://vimeo.com/237730655>

In keeping with MSU’s public mission, the University requires that theses, dissertations and abstracts will become public after the conferral of the degree; embargoes can only be pursued for a limited period (see [1] below). Results that are subject to restrictions for dissemination by funding agencies (see [2] below) cannot be part of any document submitted as a thesis or dissertation to the Graduate School.

[1] Hold/embargo on publication of documents submitted to ProQuest:

Students submitting a thesis/dissertation to ProQuest now can request a hold/embargo of publication by ProQuest by contacting the Graduate School at msuetds.approval@grd.msu.edu. In response to the request, the Graduate School will send directly to the student a form that needs to be completed and turned to the Graduate School prior to submission of the document to ProQuest. The form needs to be signed by the student’s major professor and by the Associate Dean of the student’s college. The request for the hold/embargo may be for six months, one year or two years. Requests for a period longer than six months must include a written justification for the length of the hold/embargo.

[2] Graduate students' participating in University Research Organization (URO; <https://uro.egr.msu.edu/>):

Graduate students involved in a URO project will receive both written documentation and a verbal explanation of any limitations or implications to their current or future academic progress prior to participating on the project. Students engaging in work for a URO project

undergo a 2-step approval process before hiring: a consultation with a representative of the URO's office to explain the restrictions on the project, and an interview with the Graduate School Dean or Dean's designee to discuss the relationship, if any, between their work as graduate students and their participation in the project. Students must be informed that results that are subject to restrictions for dissemination cannot be part of any document submitted as a thesis or dissertation. As part of their degree program, all graduate students must have research options to ensure the generation of appropriate results to fulfill the degree requirements, and to have data for professional development activities that are integral to their graduate education (e.g., presentations at conferences and research seminars).

7. Annual Evaluation of Academic Performance

Graduate students have the right to periodic evaluations to assess their academic progress, performance and professional potential (see section 2.4.8 of the MSU Graduate Students Rights and Responsibilities, available at <https://grad.msu.edu/gstrr>). To facilitate this feedback process, all graduate students in the Department are required to submit an annual report of their academic and research progress. Their research adviser will review and provide feedback on this report, and the final copy will be added to the student's graduate file. Annual reports are due by January 31 of each year; failure to submit a complete annual report by the deadline will result in a hold being placed on the student's account. The BAE Department reporting is conducted via the College of Engineering reporting GRS portal. For more information and instructions for submitting your annual report, please see: <https://www.egr.msu.edu/grs/> Areas of concern related to performance should be promptly shared with the student by the major professor.

The following items are considered as part of the evaluation:

- Academic Ability
 - Individual grades and grade point average
 - Progress on special problems topics, thesis or dissertation.

- Analytical Ability
 - Student's initiative in the choice of a research topic.
 - Student's initiative in the analysis of a research topic.
 - Student's performance in the execution of research.

- Communication
 - Student's ability in oral communication.
 - Student's ability in written communication.

When the student's performance or progress does not meet departmental requirements, he/she shall be notified by the major professor and/or department chairperson and/or a delegated representative. When the deficiencies affect the student's status in a degree program, he/she shall be promptly informed in writing and will be provided a timeline, determined by the student's guidance committee, for corrective action and expectations.

Students may challenge the outcomes of the annual evaluation, or any other aspect of information that is added to their files, by writing a letter to the Chairperson of the department.

Should the Chairperson be the student's major professor, the letter and mode of resolution and action will be opted to the Department Graduate Program Director. The letter will be added to the student's file.

7.1 Graduate Student Vacation and University Holidays

All students are expected to have time off for vacation and regular University holidays. The extent and timing of vacations, as well as holiday time off, should be determined in consultation with the supervisor responsible for their source of support. The factors to be considered include the student's work responsibilities, as well as need for work-life balance.

8. Integrity and Safety in Research and Creative Activities

8.1 Integrity in Research and Creative Activities

The conduct of research and creative activities by faculty, staff, and students is central to the mission of Michigan State University (Michigan State University "Mission Statement" approved by the Board of Trustees on April 18, 2008 (<http://president.msu.edu/advancing-msu/msu-mission-statement.html>) and is an institutional priority. Faculty, staff, and students work in a rich and competitive environment for the common purpose of learning, creating new knowledge, and disseminating information and ideas for the benefit of their peers and the general public. The stature and reputation of MSU as a research university are based on the commitment of its faculty, staff, and students to excellence in scholarly and creative activities and to the highest standards of professional integrity. As a partner in scholarly endeavors, MSU is committed to creating an environment that promotes ethical conduct and integrity in research and creative activities.

Innovative ideas and advances in research and creative activities have the potential to generate professional and public recognition and, in some instances, commercial interest and financial gain. In rare cases, such benefits may become motivating factors to violate professional ethics. Pressures to publish, to obtain research grants, or to complete academic requirements may also lead to an erosion of professional integrity.

Breaches in professional ethics range from questionable research practices to misconduct (MSU Faculty Handbook, Chapter VI, "Research and Creative Endeavor—Procedures Concerning Allegations of Misconduct in Research and Creative Activities", (<https://hr.msu.edu/policies-procedures/index.html>)). The primary responsibility for adhering to professional standards lies with the individual scholar. It is, however, also the responsibility of advisors and of the disciplinary community at large. Passive acceptance of improper practices lowers inhibitions to violate professional ethics.

Integrity in research and creative activities is based not only on sound disciplinary practice but also on a commitment to basic personal values such as fairness, equity, honesty, and respect. These guidelines are intended to promote high professional standards by everyone - faculty, staff, and students alike.

Key Principles

Integrity in research and creative activities embodies a range of practices that includes:

- Honesty in proposing, performing, and reporting research
- Recognition of prior work
- Confidentiality in peer review
- Disclosure of potential conflicts of interest
- Compliance with institutional and sponsor requirements
- Protection of human subjects and humane care of animals in the conduct of research
- Collegiality in scholarly interactions and sharing of resources
- Adherence to fair and open relationships between senior scholars and their coworkers

Students and faculty are encouraged to read the complete text of “Guidelines for Integrity in Research and Creative Activities” at:

(<https://grad.msu.edu/sites/default/files/content/researchintegrity/guidelines.pdf>).

8.2 Responsible Conduct of Research (RCR) Training Requirements

Michigan State University takes seriously the responsibility to train students in the responsible conduct of research. In alignment with policies established by the University and the MSU Graduate School (<https://grad.msu.edu/researchintegrity/>), **all graduate students within the College of Engineering are required to participate in appropriate RCR training each year.** Please see the College website (<http://www.egr.msu.edu/academics/graduate/rcr>) for information on specific training requirements, reporting procedures, and annual deadlines. Failure to complete and report annual RCR training by the specified deadlines will result in a hold being placed on students’ accounts.

Doctoral students will need to have met the requirement for six (6) hours of discussion-based training before they reach candidate status (i.e., have passed their comps).

Additional information associated with RCR and more specific to the BAE Department can be found on D2L ->BE Graduate Studies -> RCR Training.

Students should be logging into the ABILITY information management system at <http://ora.msu.edu/train/> to complete their on-line RCR training. This is the system that must be used for proper documentation of training. This system has replaced SABA effective December 2018.

8.3 Office of Environmental Health and Safety (EHS)

The use of hazardous materials in research, teaching, and outreach activities is subject to state and federal laws and guidelines. The Vice President for Research and Graduate Studies has been assigned responsibility to see that appropriate practices are followed where hazardous

materials are involved, to maintain a safe environment for campus personnel, to protect the surrounding community, and to assure that MSU meets its obligations under the law.

Oversight of activities involving hazardous substances is provided by the EHS. EHS is assisted by faculty committees in the area of radiation safety, chemical safety, and biological safety. The Radiation Safety Committee has responsibility and authority under federal law for specific actions.

It is University policy that faculty members and principal investigators (PIs) are responsible for the day-to-day safety and well-being of all personnel engaged in activities under their aegis. Administrative officers, and EHS, are responsible for making available to faculty information needed to maintain a safe working environment, for providing safety training, for keeping project directors informed about changes in regulations, and for assaying laboratories and work areas for radiation, chemical, or biological hazards.

All individuals who work with hazardous substances must accept shared responsibility for operating in a safe manner once they have been informed (a) about the extent of risk and (b) about safe procedures that should be followed.

The EHS provides live and on-line training classes (see www.ehs.msu.edu) throughout the year to educate the employees and students of Michigan State University on safe work practices. Completion of these courses by MSU personnel ensures that the university is fulfilling local, state and federal regulations in radiation, chemical, biological, hazardous waste, and environmental safety.

Your training requirements will depend on your specific job duties. Some general guidelines are listed below:

- Required for all laboratory employees engaging in the use of hazardous chemicals (and supervisors of the employees): Chemical Hygiene and Laboratory Safety; Hazardous Waste Refresher (required annually after completion of Chemical Hygiene & Laboratory Safety course) and Security Awareness.
- Required for all employees working with radiation: Radiation Safety Initial; Radiation Safety Refresher (required annually following completion of the Radiation Safety Initial course).
- Required for all employees with a reasonable anticipated risk of exposure to bloodborne pathogens/human blood/bodily fluids: Bloodborne Pathogen Initial; Bloodborne Pathogen Refresher; (required annually following completion of the Bloodborne Pathogen Initial course)

If you require assistance determining which courses you should complete, please contact the EHS at 355-0153.

Any research involving human subjects must abide by the appropriate university requirements. For additional information contact the University Committee on Research Involving Human Subjects (UCRIHS): (<http://hrpp.msu.edu/>).

Any research involving animals must abide by the appropriate university requirements. For additional information contact Michigan State University Campus Animal Resources (CAR): (<http://animalcare.msu.edu/>).

8.4 International Health & Safety

Office of International Health & Safety (<https://oihs.isp.msu.edu/>) works to support the health, safety, and security of all MSU-affiliated international travelers. This office is also responsible for pre-departure preparation and orientations; risk assessment; safety and security monitoring; serving as the health insurance liaison; 24/7 crisis management; travel registration; and preparation of proof of insurance letters.

International SOS (www.internationalsos.com) can assist with medical appointments or referrals; pre-departure health, safety, or security questions; mental health and emotional support services; and alerts while traveling.

9. Student Conduct and Conflict Resolution

9.1 Student Conduct

The University expects student conduct and behavior to reflect qualities of good citizenship. The out-of-classroom activities of Michigan State University students should reflect favorably upon the institution and should indicate the personal integrity of the individual. *See Spartan Life: Student Handbook and Resource Guide* for specific policies, ordinances and regulations that define some of the relevant University expectations.

9.2 Conflict Resolutions

Conflicts involving a graduate student may be handled informally, or at the request of a party or parties, formally. Student's rights and responsibilities, including grievance procedures, are detailed in the document: *Student Rights and Responsibilities*. Procedures more specifically designed for graduate students are to be found in the publication *Graduate Student Rights and Responsibilities*. An excellent source of information regarding grievance procedures is also available from the Office of the Ombudsperson: (<https://ombud.msu.edu/>).

Graduate students may pursue a grievance issue at the department level by notifying (in writing) the Chairperson. If this occurs, the Chairperson will appoint a grievance committee consisting of equal numbers of faculty and graduate students selected by their respective groups in accordance with the department/school/program hearing procedures. This committee will investigate the grievance issue and make a written report to the department Chairperson. Should the Chairperson of the Department be directly involved in the grievance, the Department Graduate Program Director will substitute for the Chairperson in this process.

10. Work Related Policies

10.1 Assistantships

Research Assistantship (RA) support for students is determined on an individual basis depending upon recommendations, availability of funds, fellowship and scholarship support, and grade record. A graduate assistant's responsibilities require an average of 10 hours per week for a quarter-time appointment, and 20 hours per week for a half-time appointment. Responsibilities associated with the assistantship generally align with the associated graduate student's graduate program, however, this is not a requirement. Research Assistants are expected to meet regularly with their major professor or project coordinator; and, if requested, submit regular progress reports.

Assistantships are reviewed annually by the Department Chairperson and may be renewed if satisfactory progress is being made pursuant to the expectations documented in the assistantship agreement signed by the student preceding each semester, and funds are available. Graduate assistantship support will generally be limited to two years for M.Sc. students, and four years for Ph.D. students. To request extension of assistantship support, students may petition the Department with an accompanying letter from the major professor. A student's assistantship will be terminated if his/her GPA is below 3.0. All courses including collateral courses will be used to compute the GPA.

Teaching Assistantships (TA) are of very limited availability, if at all, and must adhere to Graduate Employee Union (GEU) and English Proficiency (SPEAK test) guidelines.

MSU candidates for TA appointments who were required to demonstrate English proficiency as a condition for regular admission to Michigan State University must also demonstrate that they meet a minimum standard of proficiency in spoken English before they can be assigned teaching work that involves oral communication with undergraduate students. Those ITAs who received a waiver of the TOEFL or of other accepted tests of English proficiency for admission, must also meet the requirement of proficiency in spoken English before they are assigned to teaching work that involves oral communication with undergraduate students. To meet this requirement, those ITAs may use any of three options listed below:

- Presenting a TOEFL iBT speaking section score of 27 or higher.
- Receiving a score of 50 or higher on the [MSU Speaking Test](#)
- Taking [AAE 451](#) or [AAE 452](#) (ITA language support courses) and receiving a score of 50 or higher on the [ITA Oral Interaction Test \(ITAOI\)](#).

Individual exceptions from these requirements (on a case-by-case basis in rare circumstances) will be considered by the Graduate School in consultation with the ELC upon the request of the department and with the endorsement of the Associate Dean of the College

10.2 Office Space for Graduate Students

Definition of Space. Available office space is defined as rooms dedicated solely for graduate student offices: currently rooms 5, 6, and 9 in FAE. This policy does not include any square footage in faculty laboratories. Faculty members are responsible for all space assignments in their labs.

Allocation of Available Office Space. Vacant office space will be assigned by the Graduate Secretary on the basis of graduate student seniority based on degree program (Ph.D. students have priority over M.S. students) and number of semesters enrolled in the BE graduate program (priority increases with the number of semesters enrolled). Also, students continuing from a M.S. to a Ph.D. program have priority over new Ph.D. students.

Terminating Space. The Graduate Secretary will verify that graduating students are properly “checked-out” of their office space. Students will not receive final degree certification until keys are returned, and the office space is “cleaned-up” and ready for the next occupant.

Inactive students (temporarily, or permanently, withdrawn from MSU) are not entitled to office space.

10.3 Who to Ask for Help

It is not expected that all the answers will be found in this text. Unforeseen questions will arise and answers will be needed. In most cases, the student's major professor, the Graduate Program Director/Coordinator, or the Graduate Secretary will be able to provide the required information. Complex issues may require the advice and action of the department chairperson, certain departmental committees, and the faculty.

11. Graduate Student Mentoring and Advising

Mentoring and advising are crucial in developing a successful, productive, and rewarding experience for faculty and graduate students. The role of advising is to provide timely and accurate information about requirements, policies, and procedures. Mentoring requires a more in-depth relationship formed through mutual respect and responsibility and a shared commitment to professional excellence. The BAE department is committed to excellence in graduate education and the development of constructive relationships between graduate students, their advisors, and mentors. Scientific and professional excellence develops in an environment of respect and open communication, clear expectations, scholarship and research integrity, and commitment to professional and personal growth.

Responsibilities of the Faculty Advisor include informing the student about requirements and policies of the graduate program, providing training and guidance in research and professional development, including constructive feedback regarding progress on coursework and research activities, advising on job and career options, and assistance in achieving the requests of the guidance committee.

Responsibilities of the Graduate Student include meeting the University and BAE requirements for degree completion, learning of career and professional development opportunities, forming an informed guidance committee, displaying uncompromising honesty and integrity in research conduct, and keeping the faculty advisor and guidance committee informed of the progress toward completion of the requirements for the thesis or dissertation.

A full description of guidelines for the responsibilities of MSU, the Graduate School, the BAE department, the Graduate Program Director/Coordinator, Faculty Advisor, and Guidance Committee, and the Graduate Student is available at: <https://grad.msu.edu/msu-guidelines-graduate-student-mentoring-advising>.

12. University Resources

(NOTE! University policies in the following documents override all inconsistent provisions of the Biosystems and Agricultural Engineering Graduate Handbook)

Academic Programs:

<https://reg.msu.edu/AcademicPrograms/>

Graduate Students Rights and Responsibilities (GSRR):

<https://grad.msu.edu/gsrr>

Medical Student Rights and Responsibilities (MSRR):

<http://splife.studentlife.msu.edu/medical-student-rights-and-responsibilities-mssr>

MSU/GEU Contract:

<http://www.hr.msu.edu/documents/contracts/GEU2015-2019.pdf>

Guidelines for Graduate Student Advising and Mentoring Relationships:

<https://grad.msu.edu/sites/default/files/content/mentoring/MSU%20Guidelines%20for%20Graduate%20Student%20Mentoring%20and%20Advising.pdf>

Guidelines for Integrity in Research and Creative Activities:

<https://grad.msu.edu/sites/default/files/content/researchintegrity/guidelines.pdf>

Policy on Relationship Violence and Sexual Misconduct:

http://www.hr.msu.edu/documents/uwidepolproc/RVSM_Policy.htm

Anti-Discrimination Policy (ADP):

<http://oie.msu.edu/policies-procedures-forms/documents/2015%2009-11%20Faculty%20Guide.docx.pdf>

Other important sources of information at MSU include the following:

- International Studies and Programs regarding safety in world travel:

- <http://www.isp.msu.edu/information-resources/international-travel/>
- MSU Travel Clinic:
<http://travelclinic.msu.edu/>
 - Career and Professional Development Resources:
<https://grad.msu.edu/professional-development>

13. Extended Learning Experiences

Graduate students are provided opportunities, and are encouraged, to extend their learning, leadership, and overall experience during their graduate program. These include, but are not exclusive to, the following:

- Graduate Teaching Experience (contact your major professor or Dept. Graduate Program Director for more information.)
- Leadership in Graduate Student Advisory Group (GSAG)
- Graduate position/representatives on department, college, and/or university committees
- University specializations (such as ESPP, etc.)
- College or University Symposia
- Others...network with your peers to learn of more opportunities

Limited funding and/or fellowships to enhance graduate experiences requiring support are available from the department. Contact the Dept. Graduate Program Director for more information.