This Handbook provides information about the graduate program in Food Science at the Department of Food and Animal Sciences at Alabama A&M University.

The Department of Food and Animal Sciences offers the Master of Science (M.S.) and the Doctor of Philosophy (Ph.D.) degrees in Food Science.
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INTRODUCTION

Alabama Agricultural and Mechanical University (AAMU), Normal (Huntsville), Alabama, founded in 1875, is a land-grant institution as of 1890 under the Second Morrill Act. The University is fully accredited as a member of the Southern Association of Colleges and Schools and by 20 other accrediting organizations.

The University currently has an enrollment of over 6,000 of which about 30% are graduate students. The University is composed of the following Schools: Agricultural and Environmental Sciences; Arts and Sciences; Business; Education; and Engineering Technology. The Graduate School offers Master’s and Ph.D. level degrees and programs leading to certifications at the AA level.

The School of Agricultural and Environmental Sciences operates under the traditional land-grant concept with teaching, research and extension programs. The School aims to provide, through its several curricula modern education for individuals who are capable and have the determination to prepare for a chosen career in food and agricultural sciences, environmental science, family and consumer sciences and related scientific areas.

The instructional programs are completely integrated within the School’s research and public service activities. Even though our academic programs are recognized or accredited by several state, regional and national associations and professional societies, we are continuing efforts to improve and upgrade undergraduate and graduate degree offerings and to enhance the quality of the School’s research and extension programs. This is evident in the Department of Food and Animal Sciences and Department of Plant and Soil Science, which offer doctoral programs, and the recently revised degree option in Hospitality Food Systems Management in the Department of Family and Consumer Sciences.

Faculty and students in the School of Agricultural and Environmental Sciences are involved in basic and applied research in the areas of food bioprocessing and engineering, food chemistry and microbiology, sensory perception of product, remote sensing of terrestrial surfaces, crop production and breeding, animal nutrition and genetics, urban and rural development, plant tissue culture, food product development and human nutrition, plant molecular genetics, among others.

Additionally, the School is involved in the dissemination of research results to area stakeholders and also providing other basic extension/public service functions through an active Cooperative Extension Program. Faculty members also participate in
international development activities. The Department of Food and Animal Sciences offers the Master of Science and the Doctor of Philosophy degrees in Food Science.

In these degree programs, students may specialize in any of the following areas: food biotechnology, food chemistry, food microbiology, food engineering, food processing, product development, food sensory evaluation, nutrition, biochemistry and food toxicology.

The department is dependent upon related departmental programs for a portion of the total instructional programs, and many of our research programs are in cooperation with these departments. In addition to selected courses in the department, students take courses in related subjects such as Biology, Chemistry, Mathematics, Computer Science, Plant and Soil Science, and Agricultural Economics.

Financial assistance is available to students who qualify for graduate assistantships. Interested students are encouraged to inquire about the degree program and financial assistance from the chair of the department.

Laboratory, pilot plant, animal facilities and farmland are available for student instruction and research activities. At present, research projects in the department are funded by federal and state agencies, food industries and private foundations.

Graduates from this department may find employment with food and agricultural-related industries, various governmental agencies, experiment stations and academic institutions.
MASTER OF SCIENCE
GRADUATE STUDIES GUIDELINES

The following guidelines are intended to help standardize evaluation of students for admission, assistantships, and candidacy for the Master of Science degree in Food Science. They will also help students in planning and carrying out their responsibilities in meeting several of the deadlines and requirements.

1. PROCEDURAL: The Departmental Graduate Studies Committee (GSC) will evaluate applications for admission and Graduate Assistantships and make recommendations to the Department Chair and the Dean of the Graduate School for final action.

2. STANDARDS FOR ADMISSION: Students will be admitted to the M.S. degree program under one of the following three categories:

- **Regular Admission** – at least 2.75 (grade point average) GPA on a 4.00 scale, or 3.00 GPA in the student’s major area of concentration. Graduate Record Exam (GRE) must be taken and scores submitted.

- **Provisional Admission** – 2.50 to 2.74 GPA, or 2.75 to 3.00 GPA in the student’s major area of concentration. The GRE must be completed and scores submitted. All students admitted under this category must remove provisional status before admission as regular students and final selection of Major Advisor.

- **Special Graduate Students** – refer to Alabama A&M University Graduate Bulletin.

3. GENERAL REQUIREMENTS FOR THE MASTER’S DEGREE: The general requirements for the Master’s degree program are outlined in the Alabama A&M University Graduate Bulletin. A copy of this bulletin may be obtained from: The Graduate School, Patton Hall, P. O. Box 998, Normal, AL 35762, or at the AAMU website. The following paragraphs are intended to assist the department faculty and graduate students in facilitating the smooth functioning of their individual program(s) while conforming with the requirements of the Graduate School.
- **Graduate Student Advisory Committee (GSAC)** - Selection of an advisor and the advisory committee is of paramount importance in determining the student's M.S. program and area of specialization. Students are encouraged to give this matter due consideration. Generally, once a student has selected an advisor and advisory committee, it is difficult to change the area of thesis problem and composition of the committee. The student will select the major advisor in consultation with the department chair. (See Items 5 and 6 for nonthesis option).

- **Selection of a Major Advisor and Graduate Student Advisory Committee:**
  
  a. Each student shall review the current research being conducted by the Department of Food and Animal Sciences faculty. As the first step in selecting a major advisor and area of specialization, students are required to meet with the department chair and/or the coordinator of the graduate program. Students are also encouraged to meet personally with all graduate faculty in the department to familiarize themselves with ongoing research. Contact the department chair for a list of faculty and their areas of research concentration. **This selection should be done within 8 weeks of first semester enrollment.**

  b. Students with an interest in only one field of study may select a major advisor within the first month after approval for regular admission.

  c. Students gaining regular admission after being on provisional admission status may select a major advisor within the first month after gaining such admission.

  d. All students who do not have a (major) thesis advisor will be advised by the members of the GSC until they can select a major advisor.

  e. The student should select the GSAC in consultation with the major advisor. Each student shall have at least four faculty members on his/her advisory committee, in addition to the major advisor as GSAC chair. The majority of the committee members should be in the area in which the student is pursuing the degree. At least one member of the GSAC should be from outside the department. The student will arrange to have a GSAC meeting to approve his/her Planned Degree Program and Thesis Proposal. In some cases a committee member may withhold his/her acceptance for membership to the advisory committee until an outline of the coursework and research interest is provided by the student.
- **Departmental Seminars** – Graduate students, like faculty, are expected to attend all departmental seminars. Also, be certain to check the weekly University and School seminar lists. Seminars are part of graduate training and continued professional development. In addition, students are required to take Graduate Seminar as part of their degree programs.

**Policy Governing Graduate Seminars**

a. FAS 697 will be taken by all Food Science M.S. students.

b. All graduate students and faculty members are requested to inform the departmental seminar coordinator of individuals who would be candidates to present seminars. These individuals can come from AAMU, from elsewhere in Alabama or from out of state.

4. **PLANNED DEGREE PROGRAM AND THESIS PROPOSAL:** The Planned Degree Program (available from the GSC or Graduate School) should be completed and filed with the Graduate School before the beginning of the second semester of the student's enrollment in the Master of Science degree program. This form outlines the proposed coursework for the degree. The student should prepare a draft Planned Degree Program form in consultation with his/her major advisor. Prior to filing this form, the student should arrange a meeting with the GSAC to obtain the approval of the proposed coursework. After revisions and GSAC approval, the major advisor will submit the signed Planned Degree Program form to the Graduate School.

The M.S. student pursuing the degree with the thesis option is required to prepare a thesis proposal and arrange a meeting to have the proposal approved by the GSAC. This meeting may be scheduled separately or in conjunction with the meeting for approval of the Planned Degree Program but should occur no later than the second semester of enrollment. At this meeting, the advisory committee may offer suggestions for improving the proposed effort. After final approval of the "thesis proposal" by the advisory committee, a copy will be filed in the Graduate School. Subsequent changes in the course of the research should be approved by the GSAC.

- The research outline should consist of:
  
  a. Tentative thesis title
  b. Introduction
  c. Objectives
d. Justification (Why is such research necessary?)

e. Brief review of literature – a short statement clearly demonstrating that the thesis problem selected by the student has been chosen in light of major research done at this institution or elsewhere.

f. Methodology – should clearly outline the number of experiments to be conducted, the design of experiments, proposed statistical treatment (if any) and the time table of research.

g. List of references cited in this paper.

The entire outline, consisting of 6 points listed above, should not exceed 10 pages using the Journal of Food Science, or other recognized citations format. The student must provide a typewritten copy of the outline to committee members at least one week prior to the first committee meeting. For details, refer to the Graduate School Special Publication entitled “Thesis and Dissertation Guidelines for Graduate Studies.” A copy of the publication can be obtained from the Graduate School.

5. CANDIDACY FOR MASTER OF SCIENCE DEGREE: The student must maintain a GPA of 3.00 during the course of graduate study. A student failing to maintain at least a 3.00 GPA for 2 consecutive semesters shall not be allowed to continue in the department. Also, a student who earns more than 2 C grades will not be permitted to continue graduate study. All students on graduate assistantships are generally expected to complete their degree within 2 calendar years. Should a student take longer than 2 years, the Major Advisor may withdraw the assistantship support from the student, depending on the nature of the problem and the consideration for financial needs of other students in the department.

To be a candidate for the Master of Science degree, the student must complete the minimum requirements under one of the following options:

Thesis Option: A minimum of 24 semester credits of coursework and 6 semester credits of thesis research

Non-Thesis Option: A minimum of 32 semester credits of coursework and 4 semester credits of comprehensive Master’s Report.

(Candidacy for the Master of Science Degree requires the completion of any additional prerequisites which may be prescribed by the GSCC or the GSAC.)
A minimum of 9 semester hours of 600 level graduate courses in the major program is required of all students in addition to the thesis or the non-thesis Master's report. All Master of Science degree candidates are required to enroll in a graduate seminar course and to present at least one seminar. All students are strongly advised to enroll in the course “SPS 530- Principles of Experimentation.” The department discourages students from registering in either “FAS 696 – Advanced Topics in Food Science,” during the first semester of their Master’s degree program.

6. COMPREHENSIVE EXAMINATION: All non-thesis master’s degree candidates will be required to take a written comprehensive examination. All candidates under the thesis option will be required to take a final oral defense after they complete their thesis and have it approved by their GSAC.

7. THESIS REQUIREMENTS: The following guidelines are recommended for all thesis candidates to insure high quality, organization and uniformity of the thesis.

a. All theses generated within the department shall follow the format guidelines set by the Graduate School

b. The student should arrange with the major advisor a rigorous review schedule for draft versions of the thesis or thesis chapters.

c. A copy of the thesis should be submitted to other advisory committee members only after the major advisor has determined that the draft is well written and complete.

d. All suggested changes by committee members should be inserted and retyped before the student appears for the final oral defense. The oral examination should be scheduled at least 2 weeks before the deadline established by the Graduate School (each semester) for submitting the final copies of the thesis (5 complete documents on bond paper each signed by all GSAC members) to the Graduate School.

e. Following completion of thesis defense, graduate students are strongly encouraged to undertake development of research paper(s) based on their research for possible publication. The obvious prerequisite for accomplishing this is that the thesis problems pursued should result in new, publishable information. While designing their research, students are encouraged to give due consideration to innovation and creativity in the scientific content of their research.
8. FINANCIAL SUPPORT: The Department has several graduate research assistantships available to the students. In general, a decision of assistantship support is made after the final selection of a major advisor and selection of thesis problem. At present the support for a half-time GRA is $14,200 to 19,000/year. (see miscellaneous information for more details.)
DOCTOR OF PHILOSOPHY
GRADUATE STUDIES GUIDELINES

1. APPLICATION AND ADMISSION:

Application Procedure: Application forms for Admission and Assistantships/Fellowships can be obtained from the Graduate School or the Department of Food and Animal Sciences, or on-line (www.aamu.edu/graduatestudies/apply.html). Application forms for admission must be submitted to the Graduate School, along with requested documents. In addition, the applicant should also arrange for transcripts and at least 3 letters of recommendation to be sent to the Dean of Graduate School, P. O. Box 998, Alabama A&M University, Normal, AL 35762.

Department Admission Requirements: Following are the minimum requirements of the Department for admission into the Doctor of Philosophy degree program. Prospective candidates must have:

a. An M.S. degree in food science, nutrition, animal science, agronomy, horticulture, plant science, biology, chemistry, or closely related area from an accredited institution.

b. A minimum overall GPA of 3.00 in B.S. coursework and 3.25 in M.S. major courses taken with 3.00 in other master’s subjects.

c. A minimum combined score of 1200 on the verbal, quantitative, and analytical sections of the GRE. The applicant should have the testing service forward the scores to the Graduate School. For applicants whose medium of high school and college instruction was other than English, a minimum score of 500 on the Test of English as a Foreign Language (TOEFL) is required.

d. Three letters of reference indicating the student’s academic background and ability to pursue the Ph.D. Program, with one of these letters from the major advisor of the student (M.S. degree).

e. A personal statement on career objectives and research interest.
Departmental Graduate Studies Committee: A committee consisting of at least 3 food science faculty members will review the applications as necessary to recommend admission.

Admission Status: All students accepted into the Ph.D. program are granted a provisional admission into the program until they pass their qualifying examination. Candidates who have some deficiencies in their background but meet the general requirements of the department and the Graduate School for admission must complete the background work recommended by their GSAC with a 3.00 minimum GPA, at which time they shall be allowed to take the qualifying examination. These background courses will not be counted towards the degree requirements. Upon completion of background work as recommended by the GSAC and the student's qualifying examination, regular admission will be granted.

2. EXAMINATION AND GUIDANCE COMMITTEE PROCEDURES:

Advisory Committee: Each prospective candidate for the doctoral degree will select a major advisor in consultation with the department chair. The major advisor will act as the chair of the GSAC, direct the research and coordinate fulfillment of requirements for the degree. The selection of the major advisor should be done no later than the end of the candidate's first semester. By the end of the first semester, the student and the major advisor will select other members of the GSAC. The advisory committee shall consist of no fewer than 5 graduate faculty members, and shall be representative of the general and interdisciplinary aspects of the inquiry of the dissertation. The majority of these committee members, including the major advisor, should be food and animal science faculty. At least one of the members should be from outside the department. The names of all members of the nominated advisory committee must then be submitted by the major advisor to the department chair for approval and to the Dean of the Graduate school, who must approve and officially appoint the GSAC.

Any change in the GSAC must have prior approval of the Department and the Graduate School. A new advisory committee may be assigned to a student if the student changes to a new specialty area, or for other appropriate reasons. Normally, a change of the major advisor will not be anticipated; however, if such a request is made either by the student or major advisor, the case will be pursued through the grievances procedures outlined later in this section.
3. GENERAL REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE:

Study Loads: Normally, 7-10 semester hours are considered a full-time load for a graduate student during the fall and spring semesters, and 6 hours in the summer term. However, the student’s major advisor may determine the maximum allowable loads, depending upon the student’s other assignments (such as research involvement and research or teaching assistantship responsibilities) and academic progress. See the graduate bulletin for details and up to date information.

Academic Standards: A graduate student who fails to maintain satisfactory scholarship or make acceptable progress in this degree program, as determined by evaluation, will be dropped from the program. Evidence of unacceptable performance includes: a cumulative GPA below 3.00 for 2 consecutive semesters; more than 2 C’s in the program; unsatisfactory research performance; poor professional conduct; or disregard for property or safety as determined by the GSAC.

Termination Procedure: The student will receive an evaluation to accept or reject the progress toward the degree at the conclusion of each semester. The evaluation may be supplemented by a letter from the major advisor or the GSAC if progress is unacceptable. A graduate student may also receive a letter if the evaluation is acceptable but the major advisor has reservations related to the student’s progress or performance, or the student may be granted one semester’s probation.

If a student’s progress continues to be unsatisfactory during the semester following receipt of an unacceptable evaluation as determined by the GSAC, the student may be terminated from the program. Notification will be in writing from the Dean of the Graduate School based on the GSAC’s recommendation.

Student Probation: A student may be placed on probation for:

a. Not meeting the GPA requirement as stipulated;

b. Slow progress through the program;

c. Unsatisfactory performance on any assistantship when the responsibilities are intricately related to the dissertation research; or

d. Unethical conduct
Students placed on probation will be informed by the major advisor, or through appropriate administrative channels, of the reason for probation and necessary remedial actions. If a student continues to perform unsatisfactorily, the student will be terminated from the program.

**Student Grievances:** As a first step, the student should take a grievance directly to the individual involved. If unresolved, the student can, by petition, take the grievance to the GSC. From there, all grievances must go through the proper administrative channels. Grievances may include, but are not limited to, the following areas: probation, assistantship, practicum, evaluation (grades, job, professional attitude, and ethics), departmental policies, dissertation, and quality of teaching.

**Residence Requirements:** At least 50 percent of the credit hours required for graduation must be earned within a period of 2 consecutive calendar years on Alabama A&M University’s campus. Any deviation from this must be approved by the Department’s GSC and the Graduate School.

**Planned Degree Program and Thesis Proposal:** The Planned Degree Program (forms available from the GSC or the Graduate School) should be completed and filed with the Graduate School within the first semester of the student’s enrollment in the degree program. This form outlines the proposed coursework for the degree. The student should prepare a draft Planned Degree Program form in consultation with the major advisor. Prior to filing this form, the student should arrange a meeting with the GSAC to obtain the approval of the proposed coursework. After revisions and GSAC approval, the major advisor will submit the signed Program form to the Graduate School.

The Ph.D. student is required to prepare a “dissertation proposal” and arrange a meeting to have the proposal approved by the GSAC. This meeting may be scheduled separately or in conjunction with the meeting for approval of the Planned Degree Program but should occur immediately following the qualifying examination. At this meeting, the advisory committee may offer suggestions for improving the proposed effort. After final approval of the dissertation proposal by the GSAC, a copy will be filed in the Graduate School. Subsequent changes in the course of the research must be approved by the GSAC.
4. CURRICULUM REQUIREMENTS:

Prerequisites: All graduate students in Food Science must have taken the following courses as prerequisites. Equivalent courses taken elsewhere may be recommended by the GSAC for substitution.

- FAS 503 Food Microbiology
- FAS 507 Food Chemistry
- FAS 561 Food Engineering

Core Course Requirements for a Ph.D. Degree: The following core courses in various disciplines must be successfully completed by all graduate students pursuing this terminal degree. However, if any courses similar to these core courses have been taken and successfully completed elsewhere in an accredited university, the GSAC may exempt the student from taking duplicate core courses.

- SPS 530 Principles of Experimentation
- FAS 657 Analytical Techniques & Instrumentation

At least 3 of the following:

- FAS 701 Advanced Food Microbiology
- FAS 707 Advanced Food Chemistry
- FAS 711 Advanced Food Toxicology
- FAS 736 Advanced Sensory Evaluation
- FAS 741 Advanced Nutrition
- FAS 752 World Food Problems & Policy
- FAS 761 Advanced Food Engineering
- FAS 771 Advanced Food Biotechnology
- FAS 772 Advanced Food Processing
- FAS 782 Advanced Food Packaging

Qualifying Examination: Early in the program, the student must give evidence, by taking a qualifying examination, of being qualified to work toward a doctorate. It is recommended that the student take this examination soon after completing core course requirements, preferably no later than the beginning of the third semester of the graduate program. If the GSAC determines that the student is not prepared to take the examination, an extension of one semester may be allowed. The student will have two opportunities to pass the examination, and is required to do so prior to registering for dissertation credits. The student’s performance in the examination will provide an opportunity for the GSAC to identify strengths and weaknesses in academic preparedness and allow for developing a planned degree program focused on the intended area of research.
Minimum Required Coursework: The course requirements for the Ph.D. in Food Science will vary depending upon the student's background and interests. *Normally, a minimum of 28 semester hours (inclusive of core courses) of graduate coursework (at the 600 level or above) beyond the Master's level will be required. Nine credit hours, excluding dissertation and seminar, must be completed at the 700 level.* These courses shall be selected from the approved list and as recommended in the program of study by the student's GSAC.

Minimum Required Research Work: A written dissertation involving a minimum of 12 semester hours of dissertation research credits beyond the Master’s level must be completed to obtain the degree. The dissertation shall be completed on a topic closely related to the field of specialization. To be acceptable, it must constitute a significant contribution to current knowledge. Joint authorship will not be accepted. The completed dissertation must be approved by all members of the student’s GSAC and must bear their signatures. Manuscript preparation, submission, and other relevant procedures are to follow the Graduate School’s guidelines.

Transfer Credit: A maximum of six hours of graduate course work completed with a B or better grade may be transferred from another institution if appropriate to the student’s program and acceptable to the GSAC provided that the work was completed within the time limits approved for the earning of the Ph.D. degree at Alabama A&M University.

Off-Campus Coursework: Coursework that may be applied towards the degree requirements will normally be completed on Alabama A&M University campus. However, on some special occasions when it will enrich the student's overall program and one or more prescribed program courses are not offered on this campus, a student, with the GSAC's approval, may be allowed to take these courses at other recognized institutions which then may be applied towards the doctoral degree credit. For example, a reciprocal course enrollment agreement currently exists between Alabama A&M University and the University of Alabama in Huntsville. Such existing programmatic configurations will be utilized to reduce duplication and costs and to enhance cooperation among institutions.

Off-Campus Research: Research that is to be applied toward the dissertation normally will be completed on Alabama A&M University campus. However, for special reasons, permission may be granted by the GSAC and the Graduate School to perform the required research activity or a portion of it at another campus or organization. In such a case, the major advisor, with concurrence from the GSAC, should request approval from the Graduate School, providing justification as needed.
Seminar Requirement (2 credit hours): FAS 797 may be taken by doctoral students only. Each student will present at least 2 seminars. One may be in preparation for research on the dissertation proposal or another area of appropriate interest, and the second on the dissertation research results, normally immediately prior to the final defense of the dissertation.

Language Requirements: Prior to the final defense of the dissertation, candidates for the Ph.D. degree will be required to demonstrate a reading knowledge of at least one foreign language in which there exists a significant body of literature relevant to the major field of study, or to complete at least 3 semester hours of scientific programming language. This requirement is satisfied by a grade of B or better in a 200 or higher level foreign language course.

Teaching Requirements: All doctoral students must participate in a meaningful teaching experience as a part of their graduate program. The recommended method of satisfying this requirement is for the student to participate in the teaching of an organized course during one academic semester while enrolled.

The student is to work in conjunction with the course’s instructor and to participate fully in all aspects of the organization, conducting and evaluation of the course. The student, after consultation with the major advisor, shall be responsible for contacting the GSC chair to arrange for the completion of this requirement at least one semester before graduation.

The primary responsibility for determining how the teaching requirement is to be fulfilled rests with the student and GSC based on the teaching assistance requested by the faculty. Graduate students will be matched as closely as possible with their preferences for course and term.

Students who have previous teaching experience, or who have otherwise demonstrated a proficiency in this area, may be exempted from this requirement by their graduate committee.

Comprehensive Examination: When 80 percent or more of the prescribed coursework has been completed, the student is eligible to take the comprehensive examination. Successful completion of this exam, covering the coursework taken by the student or a subject related to an understanding of the student’s area of concentration, will be required. The student must be registered during the semester in which the comprehensive examination is taken. This examination will be conducted by the GSAC with the help of the Department and any other graduate faculty member who may have taught relevant courses. The examination will consist of two parts: (1) written
examination(s) in the major and minor field, and statistical methods which will be administered by the GSAC and (2) an oral examination. The written examination must be completed and passed within a minimum of two weeks prior to the oral examination. A unanimous vote of approval by the members of the committee will be required for the student to pass the written examination. The oral comprehensive examination may be passed by approval of a simple majority of the examining committee members. If the student does not pass the comprehensive examination, at least one semester must elapse before re-examination will be permitted. Should the comprehensive examination be administered a second time, it must be scheduled and completed not later than 6 months following the date on which the first comprehensive examination was attempted.

Should the comprehensive examination be failed twice, the student shall not be given a third examination, except upon the recommendation of the GSAC and with special approval of the Dean of the Graduate School.

5. ADMISSION TO CANDIDACY:

A student becomes eligible for admission to candidacy upon fulfilling the following requirements:

a) Filing approved dissertation proposal with the Dean of the Graduate School

b) Completion of formal coursework and filing with the Dean of the Graduate School a Planned degree form outlining all coursework, signed and approved by the GSAC.

c) Fulfillment of teaching requirements

d) Fulfillment of language requirements

e) Passing the comprehensive examination

f) Obtaining GSAC's approval of dissertation examination

Time Limitation: The comprehensive examination must be taken within 5 years, and all requirements completed within 8 years, from the time of a student's first enrollment in the doctoral degree program. Should the degree not be completed within 4 years after the passing of the comprehensive examination, the entire comprehensive examination must be rescheduled and passed again.
6. DOCTORAL RESEARCH AND DISSERTATION:

Guidelines for Preparing Doctoral Research Proposals: Each doctoral student is expected to complete and present a research project proposal to the GSAC. The proposal should be submitted no later than the beginning of the student's second semester. The approved proposal will serve as a guideline for initiation of the student's research. The final proposal must be approved by the GSAC and presented in a seminar to the Chair of the Department. The proposal should include the following.

a. **Proposed dissertation title** – Should be brief and clear.

b. **Statement of problem** – Should be stated in sufficient detail to show the nature and justify the importance of the problem, as well as possible benefits of the proposed solution.

c. **Review of literature** – Should demonstrate familiarity with pertinent previous work

d. **Objectives** – Should be concise and logical.

e. **Procedure** – Specific experimental and theoretical procedures should be given for accomplishing proposed objectives. An estimated timeframe should be included.

The following format is suggested for preparing doctoral research proposals:

**Introduction:** What pertinent question(s) are your addressing within this research? Why do these questions need answers? In what way will your research contribute to improved understanding?

a. Introduction – What pertinent question(s) are you addressing within this research? Why do these questions need answers? In what way will your research contribute to improved understanding?

b. Literature Review – What specific scientific information has been obtained by previous investigators on the subject of your research?

c. Hypotheses – What hypotheses do you plan to prove or disprove through the proposed research?
d. Objectives – What are the specific objectives for the proposed research? In other words, what do you plan to accomplish?

e. Plan of Work – What is your “plan of action” for accomplishing each objective? Describe, in detail, how you plan to perform this research.

- What is your experimental design?
- What is the sequence of steps for your research?
- How much time do you estimate that each step will require?
- What special equipment or techniques will you use in your research?

f. Research Results – In what form will you report your results? How will these results be used to draw conclusions from your research? In what ways do you anticipate that your results will contribute to specific knowledge?

Explain how your specific study provides an independent mastery about a field of knowledge and the successful pursuit of research.

In addition, each student is expected to communicate openly and frequently with his or her supervisor and GSAC. Communication – both verbal and written – is a vital part of the graduate student training process.

**Doctoral Dissertation:** Students admitted to candidacy normally direct most of their efforts towards preparation of the dissertation. The dissertation must be a contribution to knowledge in the field of food science and must demonstrate a thorough proficiency in research techniques, ability to conduct original and independent research including formulation of testable hypotheses, data collection and analyses, and skill in formulation of conclusions. The dissertation will be reviewed by all members of the GSAC and must receive their approval prior to submission to the Graduate School.

It is recognized that no program can encompass the entire spectrum of research areas in food science.

Therefore, the students will be encouraged to conduct research in areas based on past and current research performance and faculty strengths. These areas are:

a. Food chemistry
b. Food microbiology
c. Food engineering
d. Food processing
e. Food product development
f. Food sensory evaluation
g. Food toxicology
h. Nutrition and physiology
i. Food biotechnology

**Final Defense of the Dissertation:** Upon fulfilling all the aforementioned conditions, permission to hold the final defense of the dissertation will be granted by the Dean of the Graduate School. Although this examination will be conducted as an oral test primarily concerned with the dissertation and related problems, the GSAC will determine procedure and content, which may extend into subject matter related to the field. The examining body will consist of all the GSAC members. Upon extenuating circumstances, when a committee member is not available, he or she may be substituted, at the discretion of the Dean of the Graduate School, by other faculty member(s). The student must defend successfully, with no more than one dissenting vote of the examiner, to pass. Following the examination, the advisory committee will submit its recommendations to the Dean of the Graduate School regarding acceptability of the candidate for the doctoral degree. If a student fails this examination, a re-examination may be scheduled on recommendation of the advisory committee and approval by the Dean of the Graduate School.

It is expected that, along with the successful defense of the dissertation, a manuscript of the dissertation content be drafted in order to offer it for publication in a refereed journal to guarantee the student the retention of first authorship. Normally, this manuscript should be ready for journal submission within 3 months of defense of the dissertation. Should the student fail to produce a reasonable manuscript draft, the major advisor of the research may publish the material, taking the first authorship role.
FINANCIAL SUPPORT:
ASSISTANTSHIPS AND FELLOWSHIPS

1. OPTIONS:

a. Research Assistantships – Research assistantships are awarded on a competitive basis. They may be funded from department research funds or from grants. Assistantship support is currently from $14,200 to $19,000 per annum.

b. Teaching Assistantships – Teaching assistantships are awarded on a competitive basis and recipients are expected to assist in teaching, usually as laboratory instructors. Students recruited for teaching assistantships may subsequently be awarded a research assistantship but are usually expected to serve as a teaching assistant for several semesters. The Department awards very few teaching assistantships

c. Fellowships – Fellowships are awarded from the public or private funds received in the Department and through the Graduate School. Such awards are highly competitive. Examples of the fellowships are Academic Year Fellowships and Minority Fellowships. If the fellowship stipend is not equivalent to a research assistantship stipend, the fellowship may be supplemented within the limits established by the Graduate School. The deadline for fellowship application is usually prior to February 1 of each year.

2. APPLICATION:

Application for assistantships and/or fellowships should be made at the time of application for admission. Forms are included in the application packet. The application should be submitted prior to January 30 for students planning to enroll for Fall semester. Evaluation for assistantships and fellowships is based on academic record, GRE scores, letters of recommendation and any other available information relevant to evaluating the academic potential of the student.

3. CRITERIA FOR ASSISTANTSHIP AWARDS:

Assistantships are awarded on a competitive basis. Since the number of available assistantships is usually less than the number of qualified applicants, the requirements for an assistantship may exceed requirements for admission. Students having the best academic record and potential for successfully completing graduate study are given
highest priority for assistantship support; however, exceptions can be made for the following reasons:

a. Extraordinary number of students in the area of specialization or with an individual faculty member.

b. Need for additional students in an area of specialization.

c. Availability of funds, particularly for assistantships supported by research grants.

4. DUTIES:

Graduate Research Assistantships are awarded for financial support of the student, not for thesis or dissertation research. The thesis or dissertation is the student's own work; however, the research is almost always consistent with the long-range objectives of the major advisor's research program. Graduate assistants are expected to assist the major advisor, who may request assistance in non-dissertation research or participation in activities for the student's educational benefit.

Research assistantships are generally referred to as half-time assistantships, implying that the recipient should devote approximately 20 hours per week to research or assigned duties. The departmental philosophy is that commitment and dedication are essential characteristics of a good graduate student, that an assistantship should provide the student with an opportunity to devote his/her full attention to study and graduate research, and that successful graduate study demands very frequent evening and weekend work. An effort is made to evaluate ambition, motivation and commitment in awarding assistantships. Students are generally given flexibility in arranging their study and work schedules with the expectation that the supervision of working hours will be unnecessary.

5. ENROLLMENT REQUIREMENT

Doctoral students receiving assistantships or fellowships must be enrolled for a minimum of 6 credits each semester (3 credits in summer semester). During the final semester while defending the dissertation the student may register for a minimum of 1 credit hour or as required by the Graduate School.
6. DURATION

Fellowships are usually awarded for the academic year, the duration being established by the Graduate School.

Graduate research assistantships are awarded on a 12-month basis subject to renewal providing the student is making satisfactory progress. The following rules apply for half-time assistantships:

a. Master of Science – Assistantships will terminate at the end of 2 years.

b. Ph.D. Degree – From Master’s Degree – Assistantships will terminate at the end of the third year.

Extension of assistantships beyond the normal termination can be granted on a semester-by-semester basis if extenuating circumstances occur. The extension must be requested by the GSC. The request must be accompanied by a report of progress and justification for extension by the Major Advisor.
MISCELLANEOUS INFORMATION  
(M.S. and Ph.D)

Presentation of Research Results at Technical Meetings: Students are encouraged to attend scientific meeting and present papers in their fields of interest. Though the Department cannot always assure financial support for out-of-pocket expenses, partial assistance may be provided to students when funds are available. Frequently, transportation to meetings may be provided for students presenting papers. Grant funds can be used when possible to provide partial travel support.

Petitions Regarding Graduate Requirements: Petitions regarding waivers or alterations of any graduate requirements must be submitted to the Graduate school by the GSAC chair on or before the last day of classes in the term preceding the term in which the degree is awarded. Copies of each petition must be forwarded to the GSC chair.

Desk Space Assignment: Office space is assigned to graduate students on a space-available, priority basis, with assignments being made by the major advisor. Most office space, at present, is in conventional offices shared by other graduate students, with some desks located in laboratories as well.

Facilities: Training in food science discipline requires extensive facilities. Because of an aggressive research posture in the department, our teaching and research facilities are as good or better than many of the larger land-grant institutions. The major analytical equipment and facilities include: high-performance liquid chromatographs, gas chromatographs/MS, clinical analyzer, ultra centrifuge, freeze-dryer, spray dryer, atomic absorption spectrophotometer, ICP spectrometer, UV/VIS spectrophotometers, microscopes (light and scanning electron), tissue culture and remote sensing laboratories, molecular genetics laboratory, computer and data analysis capability (both mainframe and microcomputer systems) and growth chambers.

Computer Facilities: Financial support for statistical analysis using computers for thesis or dissertation research activities and other work-related assignments will normally be available through the student’s major advisor. Computer support available for research from the major advisor is not to be used for coursework assignments. Computer time for coursework is available through the instructor teaching the course or through a special Departmental teaching allocation. Graduate students normally do their own computer programming, but special requests for computer programming services should be channeled through the student’s major advisor. Services are not available to graduate or undergraduate students for computer programming activities.
which are part of required coursework. A microcomputer laboratory in the School has also been designated primarily for student use. Although attempts will be made to meet word processing and graphics needs, because of the limitation of microcomputers, assistance cannot be guaranteed.

**Use of University Vehicles:** State vehicles are for *official use only.* Operators of state vehicles must abide by all state laws. Special courtesy to other drivers should be exercised at all times, since one is representing the Department, University, and State when driving a state vehicle.

A valid Alabama driver’s license is required to operate State vehicles, with operation of vehicles heavier than 8,000 pounds gross requiring a chauffeur’s license as well. **Caution – Only persons employed by the University are covered by State Insurance while operating a University-owned vehicle.** A graduate student on an assistantship meets this employment criterion.

Students who wish to operate departmental/school vehicles must request authorization from the Department office. Students operating State vehicles should check with their major advisor concerning current procedures for signing out vehicles, purchase of fuel, maintenance of the vehicle log book, etc.

**Secretarial Support:** Legitimate work for graduate students by departmental secretaries includes typing of materials clearly related to faculty associated research (rough drafts, research reports, and scientific journal manuscripts). These are generally channeled via the student’s major advisor. Secretaries will not type personal letters, class reports, thesis or dissertation manuscripts, or similar materials for students. When there is a question, have your major advisor submit the material for typing.

**Financial Support for research:** Materials, supplies, equipment, travel and support services (secretarial, photocopying, drafting, and technical) required for the performance of research contributing to a departmental research program will be supported through the Department with state and federal funds, and extramural grants and contracts to the extent that funds are available. Requests for services and support are to be channeled through the student’s major advisor. Under no circumstances will such services be available for activities related to coursework, thesis, or dissertation preparation. Students are encouraged to participate with their major advisor in the preparation of grant proposals to obtain necessary support for research activities.

All purchases made for extension, research and teaching activities – whether related to dissertation research or not – must receive prior approval of the student’s major
advisor. Details for making purchases are available from the student's major advisor from the Department office.

To use library services such as computerized literature searches, billed copying services, etc., the student must obtain the approval of the major advisor and use the appropriate account number for each research activity.

Expenses for thesis and dissertation preparation - typing, drafting, paper photocopying and covers - are considered personal expenses and should be borne by the student, not the Department. Similarly, the computers in the departmental office are not available for student use. On the other hand, expenses related to the preparation of required reports or publications derived from theses and dissertations are legitimate departmental expenses.

**Annual Leave:** Students receiving financial support do not officially earn annual leave, but reasonable provisions for vacation time may be arranged with the student's major advisor. Due to the amount of coursework and research required for the degree, extended absences should be kept to a minimum. Each graduate student is expected to keep the major advisor informed of availability and work plans at all times. Time off should be mutually agreed upon by the student and the major advisor.

**Use of Pilot Plant, Special Laboratory Equipment and Facilities:** Graduate students are often expected to fabricate experimental equipment needed, which is otherwise not available, for thesis or dissertation research. Such fabrication may be performed in the departmental facilities by students having experience or training in the use of the equipment. Students must follow all policies and procedures regarding effective and safe use of the shop and other areas.

**Outside Employment:** Outside employment that interferes with a student's assistantship obligations or with the graduate program is prohibited. In addition, no University equipment, facilities, or personnel may be used in connection with outside employment.

**Termination/Probation Grievances:** Policies and procedures for pursuing grievances, when informal resolution has not proven effective, must be in writing and submitted to the GSAC, Department Chair, Dean of the School of Agricultural and Environmental Sciences, and Dean of the Graduate School before submission to the Vice President of Academic Affairs.

Academic progress and research progress will be reviewed at least once a year by the major advisor in the case of doctoral students. The faculty will require that the
program and the progress of Ph.D. students be reviewed by the GSAC before the completion of the student’s second full semester. Students who are placed on academic probation because of failure to meet the required 3.00 GPA will automatically be placed on probation with respect to the assistantship. The assistantship will be terminated if the student is not removed from academic probation after one semester unless extenuating circumstances can be satisfactorily demonstrated to the GSC.

Other reasons for terminating an assistantship prior to completion of degree requirements or prior to the normal termination date identified under “Duration” are:

1. Failure to make satisfactory research progress as determined by the major advisor and/or advisory committee.

2. Unable to pass the Ph.D. Comprehensive Examination in no more than two attempts.

3. Failure of the final Oral Defense Examination for the Ph.D. degree

Normally, termination of an assistantship is recommended by the major advisor and/or the GSAC, reviewed by the GSC, and approved by the Department Chair, Dean of the School, and Dean of the Graduate School.
COURSE DESCRIPTIONS

FAS 503 Food Microbiology - Four semester hours. Theoretical and practical studies on the role of microorganisms in foods pertaining to processing, preservation, spoilage and pathogenicity. Quantitative and qualitative microbial evaluation procedures applicable to food industry and science. Term paper and presentation of current topics in the subject area are required. (Prerequisite: BIO 330 and BIO 330L) Fall.

FAS 504 Animal Hygiene and Parasitology - Four semester hours. This course gives the student a comprehensive background in the housing and management of farm animals. It also deals with parasitic diseases in farm animals. The laboratory is intended to give practical training in the identification of parasites. (Prerequisite: BIO 103, BIO 103L) Spring.

FAS 505 Meat Science and Technology - Three semester hours. Histological and physiological aspects of skeletal muscle affecting meat quality. Principles of processing and preservation of meat and meat products. Methods of studying and evaluating meat characteristics and composition. Selection, identification and utilization of wholesale and retail cuts of meat. Term paper and presentation of current topics in the subject area are required. Even Fall.

FAS 507 Food Chemistry - Four semester hours. This course is designed to provide a broad overview of the chemistry of food constituents and their contribution to functional, flavor and textural characteristics, chemical and physical changes in food components during processing and storage. (Prerequisites: CHE 301, CHE 301L or consent of Instructor) Fall.

FAS 508 Food Analysis - Four semester hours. This course will train the student in the methods of analysis of foods and their application in the food industry. Analytical procedures using current equipment for the detection and quantitation of nutrients, antinutrients and other components will also be discussed. (Prerequisite: FAS 507 or Consent of Instructor) Spring.

FAS 521 Poultry Products Technology - Three semester hours. Factors affecting poultry products quality, their identification, control and maintenance. Procurement, processing, packaging and distribution of poultry products. Term paper and presentations of current topics in the subject area are required. Odd Fall.

FAS 528 Physiology of Reproduction - Four semester hours. A study of early fetal growth, differentiation and development of the gonads, secondary sex organs and the gametes. Comparative anatomy and physiology of the male and female reproductive tracts of the common domestic species; including mechanism of endocrine control of reproduction, fertilization, cleavage, implantation and parturition. Advantages of cryopreserving sperm, ova and embryos are also discussed. Spring.

FAS 538 Fruits, Vegetables and Cereal Products Technology - Three semester hours. The post harvest handling of fruits, vegetables and cereals including storage, preservation and utilization; post harvest physiology, controlled atmosphere storage, processing and preservation.
etc. will be discussed. Experience is provided in developing appropriate information and applying it to the decision making process in the food industry. Odd Spring.

**FAS 550 Regulation of Food Safety and Quality** - Three semester hours. This course will focus on the history of food laws and regulations; various agencies involved in enforcing the food laws; and how these agencies carry out their assigned duties. This course is open to other majors. (Pre-requisite: consent of Instructor) Spring.

**FAS 551 Food Quality Assurance** - Three semester hours. This course deals with the basic principles of quality assurance related to the food processing industry. Various attributes and characteristics of food quality and product quality evaluation methods will be presented to set forth examples of producers, processors, consumers and regulator's concerns in maintaining food quality. Odd Fall.

**FAS 553 Agricultural Biochemistry** - Four semester hours. This course is designed to introduce the student to the fundamentals of biochemistry. Intermediary metabolism, mechanism of inheritance and gene manipulation techniques will be discussed. Laboratory deals with basic techniques in biochemistry. (Prerequisites: CHE 204, CHE 301 or equivalent) Fall.

**FAS 561 Food Engineering** - Four semester hours. This course includes the principles of elementary mechanics, physical properties of food and processing materials, heat transfer, fluid mechanics, psychrometrics, refrigeration and dehydration for design of food processing systems. Steady and unsteady-state heat transfer problems. To analyze the different aspects of a food system from the engineering view point. (Prerequisites: MTH 126 and PHY 103) Fall.

**FAS 572 Food Processing** - Four semester hours. Application of basic principles and practices of units operations for food processing and preservation. Understanding of prediction methods for design of food processes such as canning, freezing and dehydration. Effect of processing on food quality, food storage. Class presentation and a term paper are required. (Prerequisite: FAS 461L/FAS 561) Spring.

**FAS 605 Special Problems** - Two to three semester hours. A detailed experimental study of a chosen problem in food science or animal science areas. (Prerequisite: Consent of Instructor)

**FAS 611 Food Toxicology** - Three semester hours. Principles and problems in evaluating the wholesomeness and safety of foods, food components, additives and contaminants; selective toxicity, detoxication mechanisms, structure and biological activity of food toxicants. Fall.

**FAS 615 Food Enzymes** - Three semester hours. Even though the course will deal with properties of enzymes in general, emphasis will be placed on those properties of enzymes used specifically in food processing and practical application of enzymes at the various phases of the food industry. Fall.

**FAS 617 Food Flavors and Pigments** - Three semester hours. A detailed study of chemistry and organoleptic characteristics of flavor compounds, food colors and pigments, formulations, modification, methods of incorporation and regulatory considerations. Odd Spring.
FAS 622 Advanced Livestock Judging - Two semester hours. Advanced instruction and training for prospective livestock judging instructors. In depth study of criteria involved in accurate evaluation, objective and mental measurements for assessing the breeding or market value of different livestock species. Special emphasis is placed on proper procedures for giving oral reasons in comparing beef cattle, dairy cattle, horses, poultry, rabbits, sheep, goats and swine. (Prerequisite: FAS 355 or consent of Instructor) Summer short course.

FAS 623 Quantitative Genetics - Four semester hours. Advanced principles of animal and plant breeding with emphasis on quantitative techniques used to augment genetic improvement. Access to computer facilities and software programs which simulate various selection strategies based upon biological genetic systems will be available. Spring.

FAS 626 Ruminant Nutrition and Metabolism - Three semester hours. Principles of ruminant digestion and metabolism with emphasis on nutritional factors in production and fundamentals of evaluative research. Odd Spring.

FAS 630 Advanced Reproductive Physiology of Vertebrates - Three semester hours. This course presents topics associated with relevant advances in mammalian reproduction and biotechnology research. Topics include: physiology, morphology and development of gametes; transport and survival of gametes; fertilization, cleavage and implantation; experimental manipulation of embryos; the ovary-folliculogenesis, egg maturation and ovulation; the testes - spermatogenesis and androgen synthesis; maternal recognition and maintenance of pregnancy, induction of parturition and causes of abortion. (Prerequisite: FAS 430 or consent of instructor) Even Spring.

FAS 632 Monogastric Nutrition and Metabolism - Three semester hours. Review of recent advances in monogastric nutrition and metabolism. Discussion of nutrient requirements, balancing rations for livestock animals and balanced diets for human beings. Student seminars on current topics in monogastric nutrition. Fall.

FAS 640 Product Development and Research - Three semester hours. Students will learn the art, science and technology of developing and marketing new food products through lecture and hands-on experience. Each student will be responsible for submitting a proposed topic, literature review and proposed methodology for manufacturing the product. Product models will be further tested. Spring.

FAS 642 Minerals and Vitamins in Foods and Nutrition - Three semester hours. Chemical structures and analytical methods applicable to minerals and vitamins. Role of minerals and vitamins in the food industry and their importance in nutrition and diseases. Spring.

FAS 644 Proteins in Foods and Nutrition - Three semester hours. Supply and the need of proteins in the world; characteristics of proteins from animal and plants; processing and preservation of protein foods; unconventional protein sources; assimilation and importance of proteins in nutrition including effects of toxic proteins, peptides and amino acids. Odd Spring.

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FAS 646 Carbohydrates and Lipids in Foods and Nutrition - Three semester hours. Physical and Chemical structures; analytical methods applicable to research; and reactions, interactions and metabolism of carbohydrates and lipids in food industry and diseases. Spring.

FAS 654 Food Microbiological Techniques - Three semester hours. An advanced laboratory techniques course stressing analytical examination of microorganisms in food systems. (Prerequisites: FAS 503 and FAS 507) Odd Spring.

FAS 657 Analytical Techniques and Instrumentation - Three semester hours. This course is designed to review modern techniques and instrumentation used in analyzing and characterizing food components. Odd Spring.

FAS 658 Food Microstructure - Three semester hours. Microstructure of foods will be studied using scanning and transmission electron microscopy, light microscopy and fluorescence microscopy. Effects of various processing methods in relation to the microstructure, identification and characterization of macromolecules and use of x-ray microanalyses in evaluating mineral composition of foods will also be covered. Preparation methods for food samples for studying microstructure, interpretation of micrographs, and identification of food components will be covered. Even Spring.

FAS 662 Food Rheology - Three semester hours. Concepts, principles and application of rheology with focus on food and related biological materials. Study of standard rheological methods and mathematical relationships describing major rheological variables. Relationship between rheology and texture. Principles and application of extrusion to food materials. Fall.

FAS 671 Introduction to Biotechnology - Three semester hours. Provides an assessment of the accomplishments and future of biotechnology and genetic engineering and their application to human health, food, plants and animals. The student will learn the basic principles of recombinant DNA technology, plant and animal biotechnology, Federal regulation of biotechnology, job categories and more. Fall.

FAS 676 Food Processing and Nutrients - Three semester hours. Deals with those principles that relate processing procedures to the nutritional value of foods. The effects of various production, processing, storage and packaging techniques on nutrient availability and retention including nutrition labels on foods. Even springs.

FAS 686 Advanced Topics in Animal Science - One to three semester hours. Students may choose to study selected topics in animal breeding, animal nutrition, poultry production, animal physiology or dairy science. A comprehensive study of the selected topic will be made. Fall.

FAS 697 Seminar - One semester hour. A review and discussion of current literature in food science and animal science. Students will prepare a presentation to students, colleagues and faculty. Fall and Spring.
FAS 698 Master's Report - Research Paper - One to four semester hours each.

FAS 699 Research for Master of Science - One to six semester hours each.

FAS 701 Advanced Food Microbiology - Three semester hours. This course is open to advanced graduate students. Current literature discussions will include: newly emerging food pathogens and their control, food spoilage microbes and the utility of microorganisms in processing and preservation of food and their potential health benefits. Even Summer.

FAS 707 Advanced Food Chemistry - Three semester hours. The course will review recent advances in chemistry and biochemistry of foods including chemical reactions occurring during food processing, storage and utilization by man. Odd Summer.

FAS 711 Advanced Food Toxicology - Three semester hours. A review of recent advances in food toxicology including methodology of evaluation of toxicants, detoxification mechanisms, biological activities and regulatory and legal considerations. Spring.

FAS 736 Advanced Sensory Evaluation - Three semester hours. An experimental study of the effects of variations in treatments on the quality of food, with an emphasis on panel training, product optimization and correlations of sensory data with objective measure of foods. Activities in sensory laboratory are integral to instruction. Even Summer.

FAS 741 Advances in Nutrition - Three semester hours. Discussion topics in this course will encompass advances in nutritional methodologies (heavy isotopes, non-invasive techniques), current aspects of impact of food processing on nutrition and health, and other topics of interest to the students. Fall.

FAS 761 Advanced Food Engineering - Three semester hours. Thermodynamics, reaction kinetics and transport phenomena fundamentals in food rheology, heat transfer, freezing and melting processes, evaporation and dehydration, and other physical separation processes employed in food industry will be considered. Odd Spring.

FAS 771 Advanced Food Biotechnology - Three semester hours. Provides an assessment of the accomplishments and future of food biotechnology. The students will study how specific genes are isolated, cloned and used to transform plants, animals and micro-organisms to enhance or produce new ingredients and how fermentation technology, genetic engineering, bioprocessing, and monoclonal antibody production can be of benefit to human health and nutrition. FDA regulations and social and ethical ramifications of biotechnology will be discussed. Spring.

FAS 772 Advanced Food Processing - Three semester hours. Methods of food preservation and ingredient manufacture by radiation, heat processing, dehydration and chilling with emphasis on the unit operations including design and operation of the various food processing equipment used in the food industry will be studied. Even Summer.
**FAS 796 Advanced Topics in Food Science** - One to three semester hours. Students may choose to study the selective topics in cereals, meats, food product development and formulation, food microbiology, sensory evaluation, dairy products technology or post-harvest physiology and processing of fruits and vegetables. A comprehensive study of the selected topics will be made. Fall.

**FAS 797 Seminar** - One semester hour. Food science faculty and Ph.D. students reviewing current developments in food science and related topics through visiting presenters and by review of literature.

**FAS 799 Research for Ph.D.** - Three to twelve semester hours each. Thesis candidate's preparation and defense of thesis research.