Typical employment areas for graduates of the food science and nutrition program include quality assurance, quality control, product development, food processing, sensory science and flavor chemistry. The food science curriculum meets the accreditation standards established by the Institute of Food Technologists.

Faculty

Professor M. Lin**, A. Mustapha**
Associate Professor A. D. Clarke**, I. U. Gruen**, B. Vardhanabhuti**
Assistant Professor K. Krishnaswamy*
Adjunct Associate Professor L. Occena-Po*
Adjunct Assistant Professor G. Zheng*
Adjunct Instructor M. Jones

- Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.
- **Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

- BS in Food Science and Nutrition (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/foodscienceandnutrition/bs-food-science-nutrition/)
- Minor in Food Science and Nutrition (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/foodscienceandnutrition/minor-food-science-nutrition/)

The department offers the Bachelor of Science degree with a major in Food Science and Nutrition within four tracks, namely Food Science, Food Business, Enology and Culinary Sciences. A minor is available.

Note: Tracks do not appear on transcripts or diplomas.

Graduate

The Food and Hospitality Systems Graduate Program offers M.S. and Ph.D. graduate degrees under three track options: Food Science, Hospitality Management and Agricultural Systems Management. We also offer an online graduate certificate program in Food Safety and Defense. The catalog provides a complete list of these degree options (http://catalog.missouri.edu/degreesanddegreeprograms/).

F_S 1010: Introduction to Viticulture and Enology
This course will give a general overview of growing grapes (viticulture) and winemaking (enology) with an emphasis on Missouri wines and wineries. This course is the first course in a sequence of courses in the viticulture and enology track of the food science degree program.

**Credit Hours: 1

F_S 1020: World Food and You
(same as PLNT_S 1020). Basic scientific principles involved in production agriculture, food processing, marketing and consumption. Evaluation and understanding or current agriculture issues that affect human foods and required nutrients.

**Credit Hours: 3

F_S 1030: Food Science and Nutrition
Basic principles of science and technology as applied to the problem of providing safe, nutritious, and desirable food for man.

**Credit Hours: 3

F_S 2131: Dairy Products Evaluation
(same as AN_SCI 2131). Sensory Evaluation and judging of dairy products.

**Credit Hours: 2

F_S 2172: Elements of Food Microbiology
Introductory microbiology course stressing basic principles as related to foods.

**Credit Hours: 3
Prerequisites:
Sophomore standing. Restricted to Food Science Students during Early Registration

F_S 2195: Grapes and Wines of the World
(same as PLNT_S 2195). Explores the world of wine through study of viticultural principles and practices, wine styles, classifying wine, the winemaking process and New World and Old World wine regions. Learn wine tasting skills and experience wines from around the world. World wine consumption, social and physical health benefits of moderate wine consumption.

**Credit Hours: 3

F_S 2199: Seminar in Professional Development
Readings and discussion related to professional development for the industry.

**Credit Hours: 1

F_S 3190: Study Abroad: International Meat, Dairy and Enology
(same as AN_SCI 3190). This study abroad course introduces students to the meat, dairy and wine industries in Germany or in New Zealand (destinations are on a rotational basis). Students will visit small, medium and large-scale producers and learn about differences in comparison to the US industries. May be repeated once for credit. Prerequisites: instructor's consent

**Credit Hours: 3
F_S 3190H: Study Abroad: International Meat, Dairy and Enology - Honors
(same as AN_SCI 3190). This study abroad course introduces students to the meat, dairy and wine industries in Germany or in New Zealand (destinations are on a rotational basis). Students will visit small, medium and large-scale producers and learn about differences in comparison to the US industries. May be repeated once for credit. Enrollment is limited to Honors eligible students.

Credit Hours: 3
Prerequisites: instructor's consent

F_S 3210: Kitchen Chemistry
This course is targeted at current Food Science, Hospitality Management, Nutrition or Biochemistry students who wish to study the application of scientific principles to the practice of cooking. This on-line summer class assumes students have access to a working kitchen. Video cooking projects are submitted weekly. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: CHEM 1100 or higher

F_S 3214: Principles of Meat Science
(same as AN_SCI 3214). Study of the principles involved in the conversion of living animals to meat and by-products; efficient utilization of meat as a food.

Credit Hours: 3
Recommended: one course in Biological Sciences

F_S 3231: Principles of Dairy Foods Science
(same as AN_SCI 3231). Technology, chemistry and microbiology related to milk and its transformation into fluid milk products, fermented dairy foods and spreads. (2 hours of lecture and two hours of laboratory per week.)

Credit Hours: 3
Recommended: One course in Chemistry or Biological Sciences

F_S 3240: Principles of Viticulture I
(same as PLNT_S 3240). Grapevine growth, development, selection, propagation, training systems, pruning, and harvesting; vineyard site selection, design, and development. Graded on A-F basis only. Prerequisites: F_S 1010 and one of the following: F_S 2195 or PLNT_S 2195 or PLNT_S 2100 or SOIL 2100 or PLNT_S 2110 or PLNT_S 2125.

Credit Hours: 4

F_S 3385: Problems in Food Science
Supervised study in a specialized phase of food science and nutrition.

Credit Hour: 1-99

F_S 4160: Food Process Engineering
(same as BIOL_EN 4160; cross-leveled with BIOL_EN 7160). This course introduces underlying engineering principles in food processing, and unit operations in food industries. Topics include fluid flow, heat transfer in food processing, preservation process, dehydration, refrigeration, food freezing, psychrometrics, emerging technologies, food packaging, and sustainability. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: MATH 1100 and AG_S_M 1040 or PHYSCS 1210

F_S 4199: Food Industry Senior Seminar
The course explores the structure and the various branches of the food industry. Emphasis is placed on industry trends and the manufacture of specific selected food products and their ingredients. Graded on A-F basis only.

Credit Hour: 1
Prerequisites: F_S 1030 or equivalent, F_S 2199 or equivalent; junior or senior standing

F_S 4301: Topics in Food Science
Instruction in specific subject matter areas in the field of food science and nutrition.

Credit Hour: 1-99

F_S 4310: Food Chemistry and Analysis
(cross-leveled with F_S 7310). Structure, composition and chemical properties of food.

Credit Hours: 4
Recommended: 5 hours Chemistry or Biochemistry

F_S 4311: Investigation of Food Properties
(cross-leveled with F_S 7311). Study of the chemical and physical properties of foods and the interaction of food components.

Credit Hours: 3
Recommended: F_S 4310 or equivalent, or instructor's consent

F_S 4330: Principles of Food Processing
(same as AG_S_M 4330; cross-leveled with F_S 7330, AG_S_M 7330). Introduction to basic engineering concepts used to process raw materials. Principle topics include energy, material balance, fluid flow, heat transfer, refrigeration and freezing, and preservation.

Credit Hours: 3
Prerequisites: PHYSCS 1210, AG_S_M 1040 or Consent of Instructor

F_S 4331: Technology of Dairy Products and Ingredients
(cross-leveled with F_S 7331). Technology, chemistry, and nutrition of dairy foods as well as functional properties of dairy ingredients.

Credit Hours: 3
Prerequisites: F_S 3231 or equivalent
Recommended: one Chemistry course
F_S 4340: Principles of Viticulture II
(same as PLNT_S 4340). Environmental and biological factors influencing vine physiology and winegrape quality. Irrigation, canopy management, pest and disease control, budgets and current trends in viticulture. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: F_S 3240 or PLNT_S 3240

F_S 4344: Processing Muscle Foods
(same as AN_SCI 4344; cross-leveled with F_S 7344, AN_SCI 7344). Materials and technologies for the manufacture of muscle food products from red meats, poultry and seafood. Experience problem-solving through further processing of complex ingredients and develop skills by practicing operations in a pilot plant facility.

Credit Hours: 3
Recommended: One Chemistry course

F_S 4345: Principles of Viticulture and Winemaking
(same as PLNT_S 4345; cross-leveled with PLNT_S 7345, F_S 7345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: BIO_SC 1010 and BIO_SC 1020 or BIO_SC 1030 or BIO_SC 1200 or BIO_SC 1500

F_S 4354: Physiology and Biochemistry of Muscle as Food
(same as AN_SCI 4354; F_S 7354, AN_SCI 7354). Basic concepts in muscle growth and development of livestock evaluating the effects of environment, welfare, nutrition and genetics regarding muscle metabolism, physiology, and the ultimate condition of muscle as food.

Credit Hours: 3
Prerequisites: AN_SCI 3254 or MPP 3202 or BIO_SC 3700; AN_SCI 2001 or AN_SCI 2214 or AN_SCI 3214 or AN_SCI 3214 or F_S 3214 or AN_SCI 3231 or F_S 3231
Recommended: Any Biochemistry or Organic Chemistry course

F_S 4370: Food Microbiology
(cross-leveled with F_S 7370). Study of bacteria, yeast and molds. Includes dominant flora, public health significance, characterization of organisms, examination of foods representative of major food groups, spoilage, preservation, food fermentations and physiological groups.

Credit Hours: 3
Prerequisites: F_S 2172
Recommended: one Biochemistry course

F_S 4375: Food Microbiology Laboratory
(cross-leveled with F_S 7375). Examination of foods for microorganisms and characterization of major species.
F_S 4970: Food Product Development
(cross-leveled with F_S 7970). Capstone course integrating the various disciplines of food science to create new food products.
Credit Hours: 3
Prerequisites: Junior or Senior standing, or instructor's consent.
ENGLSH 1000 required if course is taught Writing Intensive
Recommended: 9 credit hours of Food Science

F_S 4970W: Food Product Development - Writing Intensive
Capstone course integrating the various disciplines of food science to create new food products.
Credit Hours: 3
Prerequisites: Junior or Senior standing, or instructor's consent.
ENGLSH 1000 required if course is taught Writing Intensive
Recommended: 9 credit hours of Food Science

F_S 4980: Food Quality Assurance
(cross-leveled with F_S 7360). Capstone course integrating various food science disciplines to comply with regulations concerned with protection of the nation's food supply. Applies practices to insure consumers of healthful foods.
Credit Hours: 3
Prerequisites: Junior or Senior standing or instructor's consent
Recommended: 9 credit hours of food science

F_S 7160: Food Process Engineering
(same as BIOL_EN 7160; cross-leveled with F_S 4160, BIOL_EN 4160). This course introduces underlying engineering principles in food processing, and unit operations in food industries. Topics include fluid flow, heat transfer in food processing, preservation process, dehydration, refrigeration, food freezing, psychrometrics, emerging technologies, food packaging, and sustainability. Graded on A-F basis only.
Credit Hours: 3

F_S 7310: Food Chemistry and Analysis
(cross-leveled with F_S 4310). Structure, composition and chemical properties of food.
Credit Hours: 4
Prerequisites: 5 hours Chemistry or Biochemistry

F_S 7311: Investigation of Food Properties
(cross-leveled with F_S 4311). Study of the chemical and physical properties of foods and the interaction of food components. Lecture.
Credit Hours: 3
Prerequisites: F_S 4310 or F_S 7310 or equivalent, or instructor's consent

F_S 7315: Food Chemistry and Analysis Laboratory
(cross-leveled with F_S 4315). The quantitative determination of the constituents of food.
Credit Hours: 3
Prerequisites: F_S 4310 or concurrent enrollment

F_S 7330: Principles of Food Processing
(same as AG_S_M 7330; cross-leveled with F_S 4330, AG_S_M 4330). Basic principles of food processing, with emphasis on blanching, pasteurization, commercial sterilization, refrigeration, freezing, concentration, dehydration and packing. Impacts of processing on product quality are evaluated.
Credit Hours: 3

F_S 7331: Technology of Dairy Products and Ingredients
(cross-leveled with F_S 4331). Technology, chemistry, and nutrition of dairy foods as well as functional properties of dairy ingredients.
Credit Hours: 3
Prerequisites: one Chemistry course and F_S 3231 or equivalent

F_S 7344: Processing Muscle Foods
(same as AN_SCI 7344; cross-leveled with F_S 4344, AN_SCI 4344). Materials and technologies for the manufacture of muscle food products from red meats, poultry and seafood. Experience problem-solving through further processing of complex ingredients and develop skills by practicing operations in a pilot plant facility.
Credit Hours: 3
Prerequisites: one Chemistry course

F_S 7345: Principles of Viticulture and Winemaking
(same as PLNT_S 7345; cross-leveled with PLNT_S 4345, F_S 4345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.
Credit Hours: 3

F_S 7350: Microbiology of Fermented Foods
Physiology, biochemistry, and genetics of microorganisms important in food fermentations. How microorganisms are used in fermentations and how raw materials are converted into finished fermented foods and beverages. Graded on A-F basis only.
Credit Hours: 3

F_S 7354: Physiology and Biochemistry of Muscle as Food
(same as AN_SCI 7354; cross-leveled with F_S 4354, AN_SCI 4354). Basic concepts in muscle growth and development of livestock evaluating the effects of environment, welfare, nutrition and genetics regarding
muscle metabolism, physiology, and the ultimate condition of muscle as food.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_S 7360</td>
<td>Food Quality Assurance</td>
<td>(cross-leveled with F_S 4980). Capstone course integrating various food science disciplines to comply with regulations concerned with protection of the nation's food supply. Applies practices to insure consumers of healthful foods.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>F_S 7370</td>
<td>Food Microbiology</td>
<td>(cross-leveled with F_S 4370). Study of bacteria, yeast and molds. Includes dominant flora, public health significance, characterization of organisms, examination of foods representative of major food groups, spoilage, preservation, food fermentations and physiological groups.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>F_S 7375</td>
<td>Food Microbiology Laboratory</td>
<td>(cross-leveled with F_S 4375). Examination of foods for microorganisms and characterization of major species.</td>
<td>2</td>
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</tr>
<tr>
<td>F_S 7380</td>
<td>Sensory Analysis of Food and Beverages</td>
<td>(cross-leveled with F_S 4380). Methodological principles of the sensory analysis of food and beverages.</td>
<td>3</td>
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<tr>
<td>F_S 7390</td>
<td>Optimization and Management of Food and Agriculture Systems</td>
<td>(same as AG_S_M 7390; cross-leveled with F_S 4390, AG_S_M 4390). This course is designed to introduce the student to the concept of layers and interacting systems within an operation and the analytical methods of modeling and simulation to make effective management decisions for optimal system design and function.</td>
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<tr>
<td>F_S 7440</td>
<td>Principles of Winemaking and Wine Chemical Analysis</td>
<td>(cross-leveled with F_S 4440). The theoretical and practical basics needed by enologist/winemakers including sensory analysis of grapes; chemical, microbiological and technological aspects of winemaking; and the analytical methods used for juice and wine analysis. Graded on A-F basis only.</td>
<td>4</td>
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<tr>
<td>F_S 7441</td>
<td>Cellar Operations and Special Vinifications</td>
<td>(cross-leveled with F_S 4441). The theoretical and practical basics needed by winemakers to supervise the operations of the winemaking, wine stabilization and packaging equipment. The theoretical and practical basics needed by winemakers to make special wines including rose, dessert, carbonic maceration, and sparkling wines. Graded on A-F basis only.</td>
<td>3</td>
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<tr>
<td>F_S 7910</td>
<td>Food Product Development</td>
<td>Capstone course integrating the various disciplines of food science to create new food products.</td>
<td>3</td>
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</tr>
<tr>
<td>F_S 8085</td>
<td>Problems in Food Science</td>
<td>Individual studies include a minor research problems.</td>
<td>1-99</td>
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<tr>
<td>F_S 8087</td>
<td>Seminar in Food Science</td>
<td>Provides students with opportunities for development in depth of advanced aspects of food science through reviews of research in progress and of current scientific publications.</td>
<td>1</td>
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<tr>
<td>F_S 8090</td>
<td>Research in Food Science</td>
<td>Original investigations, usually in connection with one of the research projects of Agricultural Experiment Station. Written report required. Graded on S/U basis only.</td>
<td>1-99</td>
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</tr>
<tr>
<td>F_S 8100</td>
<td>Strategic Human Resource Management in Hospitality</td>
<td>This course is designed to familiarize students with a wide range of theories, concepts, business practices and applications associated with managing human resources in business. Topics include micro-human resource issues such as recruitment, hiring, performance measurements, employee relations, and retention, macro human resource topics such as organizational performance measurement, and interrelationship between micro and macro human resources such as individual differences and job performance and organizational performance. Students will learn the</td>
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</table>
key theories and applications through reading, discussion, research, and writings. Graded on A-F only.

Credit Hours: 3
Prerequisites: HSP_MGMT 7100

**F_S 8110: Advanced Hospitality Marketing**
This course provides students with an advanced-level view of marketing strategies with the focus in hospitality and tourism. Students will be exposed to a general overview of theoretical frameworks and seminal work in this field. They will gain appreciation of the contemporary social-scientific research on marketing and persuasion. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: HSP_MGMT 7110 or instructor's consent

**F_S 8180: Strategic Management and Competitive Strategy in the Hospitality Industries**
This course introduces to students and enables them to develop a comprehensive understanding of the concepts and principles of strategic management and competitive strategy as applied to the hospitality industries. Students will be acquainted with the key concepts of strategic management through discussions, research, critiquing and writings. This course will cover a wide variety of topics related to environmental scanning, strategic direction, organizational structure and culture, administration and evaluation of existing and challenging business practices, concepts and theories in the management distinctive to that of hospitality, tourism and service. Emphasis will place on the identification of relevant interdisciplinary paradigms and theory and research techniques for analysis, using advanced concepts and quantitative methods in the scientific investigation problems related to hospitality. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: HSP_MGMT 7180 or instructor's consent

**F_S 8263: Service Operations Management: Revenue Management**
This course offers an opportunity for students to learn the theory, concepts, and knowledge applied in service operations management. Students will find them useful in trying to cope with the dilemmas faced by operating managers in the hospitality industry. Especially, the course focuses on revenue management.

Credit Hours: 3
Prerequisites: HSP_MGMT 3310 or instructor's consent

**F_S 8301: Ethnic Foods: Food Safety, Food Protection and Defense Challenges**
An overview of the safety concerns and risks associated with ethnic and imported ethnic foods. Graded on A-F basis only.

Credit Hours: 2

**F_S 8302: Food Protection and Defense-Essential Concepts**
This course presents foundational concepts relevant to protecting the food supply from intentional contamination. Graded on A-F basis only.

Credit Hours: 2

**F_S 8303: A Multidisciplinary Overview of Food Safety and Security**
This course provides students with an understanding of a host of multidisciplinary aspects of food safety, particularly in the context of public health. Graded on A-F basis only.

Credit Hours: 2

**F_S 8304: HACCP**
This course focuses on procedures and processes which can affect the overall microbiological safety of food and the Hazard Analysis Critical Control Point (HACCP) system. Graded on A-F basis only.

Credit Hours: 2

**F_S 8401: Topics in Food Science**
Specialized topics in the area of food science and nutrition.

Credit Hour: 1-99
Prerequisites: instructor's consent

**F_S 8402: Research Methods in Food Science**
(same as BIOL_EN 8402). Introduction to research. Defining research problems, developing hypotheses, searching scientific literature, designing experiments, presenting data, writing scientific papers and theses, making oral presentations.

Credit Hours: 2

**F_S 8404: Advanced Food Microbiology and Biotechnology**
Covers basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. May be repeated for credit. Graded on A-F basis only.

Credit Hours: 2

**F_S 8405: Advanced Microbiology of Foods**
Principles of microbial physiology, taxonomy, analytical methods applied to study of microorganisms added to foods and those causing food spoilage or food-borne illness. Roles of microorganisms in manufacture/distribution of foods.

Credit Hours: 3
Prerequisites: F_S 4370 or equivalent

**F_S 8406: Foodborne Toxicants**
This course covers human risks from foodborne toxicants, remediation and detoxification strategies for key foodborne toxicants and major modes of toxicity of key foodborne toxicants. Principles of food toxicology will be applied to optimize hazard analysis within HACCP for the prevention of foodborne toxicities. Graded on A-F basis only.

Credit Hours: 2

**F_S 8408: Risk Assessment for Food, Agriculture and Veterinary Medicine**
Credit Hours: 2

F_S 8410: Food Chemistry II
Study of chemical content of food, emphasizing aspects that exist uniquely in food.

Credit Hours: 4
Prerequisites: F_S 4310 or equivalent

F_S 8414: Meat Quality
(same as AN_SCI 8414). Discussion of factors affecting meat quality in beef, pork, lamb and poultry. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: F_S 3214 or equivalent

F_S 8424: Meat Investigations
(same as AN_SCI 8424). Discussion of literature, special reports, assigned readings, techniques, interpretation of results.

Credit Hours: 3
Prerequisites: F_S 4344 and F_S 4310 or equivalent

F_S 8440: Functional Foods and Nutraceuticals
Principles and challenges involved in developing foods with health benefits beyond basic nutrition; efficacy, safety, regulatory and marketing aspects of functional foods and nutraceutical; current controversies and evidence of therapeutic properties of functional foods and Dietary supplements. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: BIOCHM 3630 or equivalent and F_S 4310 or equivalent, or instructor's consent

F_S 8460: Food Biopolymers
Study of physical, chemical, and functional properties of food biopolymers and their applications in food and other industries. Graded on A-F basis only.

Credit Hours: 3
Recommended: Organic chemistry and food chemistry

F_S 8470: Advanced Food Technology
To understand the physical and chemical changes that occur during the processing and storage of food; study the quality and safety issues of foods and learn traditional and recent advances in food science and technology.

Credit Hours: 3
Prerequisites: F_S 4310, or equivalent or instructor's consent

F_S 9085: Problems in Food Science
Individual studies includes minor research problems.

Credit Hour: 1-99
Prerequisites: Food Science PhD students

F_S 9087: Seminar in Food Science
Provides students with opportunities for development in depth of advanced aspects of food science through reviews of research in progress and of current scientific publications. Prerequisites: PhD standing

Credit Hour: 1

F_S 9090: Research in Foods Science
Original investigation of advanced nature, leading to dissertation. Graded on a S/U basis only.

Credit Hour: 1-99
Prerequisites: Food Science PhD students

F_S 9402: Advanced Research Methods in Food and Hospitality Systems
This course provides doctoral students with introduction and review of research methods available for use in the study of food science, hospitality management and agricultural system management. Hence, the emphasis of this course is on empirical studies in the field, and will examine research conducted by scholars in the academic area. This course assists as baseline preparation for graduate students' continuing work in the graduate program. Specifically, the course provides students with knowledge and research experience in regard to 1) research fundamentals and backgrounds, 2) types of research, and 3) data analysis.

Credit Hours: 3
Prerequisites: Introductory research method course or statistics course; instructor's consent required