211 Principles of Food Science
Fall, Spring. 3(3-0)
Scientific principles, historical perspective, and current status of technology related to food composition, safety, toxicology, processing, preservation, and distribution.

222 Professional Development and Career Planning in Food Science
Fall. 1(1-0) P: FSC 211 or concurrently RB: Introductory course in food science R: Open to juniors or seniors or graduate students in the Department of Food Science and Human Nutrition. Theory and application of quality assurance programs for food processing industries.

240 Quality Assurance
Fall. 2(2-0) P: STT 200 or STT 201 or STT 231 or STT 315 or STT 351 and (FSC 211 or concurrently) or (ANS 201 or concurrently) or (ORN 204 or concurrently) or (HRT 204 or concurrently) R: Open to juniors or seniors or graduate students in the Department of Food Science and Human Nutrition.

241 Food Laws and Regulations
Spring. 3(3-0) P: HNF 150 or HNF 260 or FSC 211 or ABM 100 Adoption, interpretation, and enforcement of laws and regulations governing food processing and foodservice systems. Impact of regulation on food production, availability, marketing, and safety.

242 Advanced Professional Seminar in Food Science
Fall. 1(1-0) P: FSC 222 RB: Advanced course work in food science R: Open to seniors or graduate students.

325 Food Processing: Unit Operations
Spring. 3(3-0) P: FSC 221 or ANS 201 SA: FSC 229, FSC 339 Principles, technologies, and applications in conversion of raw products into high-quality foods. Unit operations: thermal processing, irradiation, freezing, membrane fractionation, enzyme technologies, dehydation, and refrigeration. Field trip required.

342 Food Safety and Hazard Analysis Critical Control Point Programs
Fall. 3(3-0) RB: (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently) or (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently) or (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently) or (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently)
Principles, technologies, and applications in conversion of raw products into high-quality foods. Unit operations: thermal processing, irradiation, freezing, membrane fractionation, enzyme technologies, dehydation, and refrigeration. Field trip required.

349 Fundamentals of Food Engineering
Spring. 3(3-0) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. P: FSC 325 and MTH 124 and PHY 231 RB: Not open to students in the College of Engineering. SA: BE 329 Definition and measurement of food properties, thermodynamics, fluid mechanics, heat transfer, and mass transfer.

430 Food Processing: Fruits and Vegetables
Fall. 3(2-3) P: (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently) or (FSC 211 or concurrently) or (HNF 150 or concurrently) or (HNF 260 or concurrently)
Principles, technologies, and applications in conversion of raw products into high-quality foods. Unit operations: thermal processing, irradiation, freezing, membrane fractionation, enzyme technologies, dehydation, and refrigeration. Field trip required.

440 Food Microbiology Laboratory
Spring. 2(0-4) Interdepartmental with Microbiology and Molecular Genetics. Administered by Food Science. P: (FSC 440 or concurrently) and completion of Tier I writing requirement. R: Not open to freshmen. Major groups of microorganisms of importance to the food industry. Ecological, physiological, and public health aspects.

441 Food Microbiology Laboratory
Spring. 2(0-4) Interdepartmental with Microbiology and Molecular Genetics. Administered by Food Science. P: (FSC 440 or concurrently) and completion of Tier I writing requirement. RB: MMG 302 SA: MPH 441 Methods for studying major groups of microorganisms important to the food industry. Isolation, enumeration, characterization, identification, and use of microorganisms.

442 Hazard Analysis Critical Control Point Training and Certification
Spring. 1(1-0) P: (MMG 301 or concurrently) or (FSC 440 or concurrently) R: Advanced course work in food science Design and implementation of Hazard Analysis Critical Control Point (HACCP) programs for the food industry. Offered second half of semester.

455 Food and Nutrition Laboratory
Fall. 3(2-3) P: (BMB 200 or concurrently) or (BMB 401 or concurrently) or (BMB 461 or concurrently) or (MMG 301 or concurrently) or (MMG 302 or concurrently) or (FSC 440 or concurrently) or (FSC 441 or concurrently) or (FSC 442 or concurrently) or (FSC 443 or concurrently) or (FSC 444 or concurrently) or (FSC 445 or concurrently)
Principles and application of analytical techniques. Analysis for fats, proteins, carbohydrates, minerals, vitamins, and additives. Techniques include spectrophotometry, fluorometry, chromatography, electrophoresis, and proximate composition.

470 Integrated Approaches to Food Product Development
Spring. 3(2-3) P: (FSC 401 and FSC 410) or (FSC 440 or concurrently) RB: FSC 325 R: Open to seniors or graduate students. Food product development including obtaining, screening, and selecting ideas. Integration of food processing, chemistry, analysis, and microbiology for the design, production, and evaluation of a food product.

477 Food Engineering: Fluids
Fall. 3(2-2) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. P: BE 350 and BE 351 and BE 360 SA: FE 465 Unit operations, process engineering, equipment, and industrial practices of the food industry. Manufactured dairy products: thermal processing, pipeline design, heat exchange, evaporation, dehydration, aseptic processing, membrane separation, cleaning, and sanitation.

481 Fermented Beverages
Fall. 3(2-2) Fall: Lansing. R: Open to juniors. Approval of department Origin and history of alcoholic beverages produced by fermentation; types of products and methods of production; relationships among agricultural practices, processing and sensory attributes; responsible consumption of alcoholic beverages.
Food Science—FSC

482 Science and Technology of Wine Production
Fall. 3(2-3) Interdepartmental with Chemistry and Chemical Engineering. Administered by Chemistry. P: CEM 143 or CEM 251 or CEM 252. Must be at least 21 years of age. R: Open to seniors or graduate students in the Department of Biosystems and Agricultural Engineering or in the Department of Chemical Engineering and Materials Science or in the Department of Chemistry or in the Department of Food Science and Human Nutrition or in the Department of Horticulture or in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Chemistry Coordinator Major. Approval of department.

Origin and history of wine and wine production. Determination and timing of harvest, methods of postharvest handling, storage, and processing of grapes into juice and wine. Physical and chemical changes in wine and processes. Analysis of must and its adjustment, fermentation, fining, and aging. Physiology of yeasts and bacteria involved in wine-making and spoilage. Cellar practices, problems, and operations.

483 Brewing and Distilled Beverage Technology
Spring. 3(2-3) Spring: Uncle John's Fruthouse Winery and Brewing Company, East Lansing. Interdepartmental with Chemical Engineering. Administered by Chemical Engineering. P: CHE 311 or BE 350 or BE 429 RB: Major in Chemical Engineering, Biosystems Engineering or Food Science. Must be at least 21 years of age. R: Approval of department.

Raw materials for fermentation and basics of alcohol fermentation, beer and cider production; basics of distillation; brandy and eau de vie production; whiskey production; vodka, gin and flavored spirits production; flavor chemistry

490 Special Problems in Food Science
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Not open to sophomores. Approval of department; application required.

Individual study of selected topics in food science. Supervised independent study.

493 Professional Internship in Food Science
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Not open to sophomores. Approval of department; application required.

Supervised professional experiences in agencies and businesses related to food science

807 Advanced Food Toxicology
Fall of even years. 3(3-0) R: Approval of department.

Toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, and chemical carcinogenesis. Risk assessment.

810 International Food Laws and Regulations
Fall, Spring. 3(3-0) RB: Food science, law, food safety, international development or related disciplines. SA: ANR 810 Survey of food laws of various countries and regions.

811 U.S. Food Laws and Regulations
Fall, Spring. 3(3-0) RB: (FSC 810) or food science, law, food safety, international development, veterinary medicine, or related disciplines. SA: ANR 811 Not open to students with credit in FSC 421. Surveys the laws and regulations governing the manufacture, distribution and sale of food products in the United States, the regulation of foods and food additives, genetic modification of food, food safety and HACCP, criminal liability for defective products, inspections, labeling, importation, exportation, and current issues of concern.

812 Food Laws and Regulations in the European Union
Fall, Spring. 3(3-0) RB: (FSC 810) or food science, law, food safety, international development or related disciplines.

Introduction to the European Union (EU), the role of case law, official controls, the European Food Safety Authority, food labeling, food additives, food fortification, genetically modified foods, organic foods, imports, food safety, inspections, enforcement and compliance, and the role of science in EU food law.

813 Food Laws and Regulations in Latin America
Fall. 3(3-0) RB: (FSC 810) or food science, law, food safety, international development or related disciplines.

Current issues that have shaped Latin American food regulation. Overview of regional characteristics. Basic food laws, agency responsibilities, product registration requirements, basic standards, food labeling, food safety, food additives, and food importation. Trade issues, international organizations, and commercial agreements.

814 Food Laws and Regulations in Canada
Spring. 3(3-0) RB: (FSC 810) or food science, law, food safety, international development or related disciplines.


815 Food Laws and Regulations in Asia
Summer. 3(3-0) RB: Food science, law, food safety, international development or related disciplines.

Current issues that have shaped the regulation of food in Asia, regional characteristics and culture, basic food laws, agency responsibilities, product registration requirements, basic standards, food labeling, food safety, food additives, food import systems. Special emphasis will be given to the food regulations of Japan, China, Korea and Southeast Asia (ASEAN).

816 Codex Alimentarius - The Food Code
Fall, Spring. 3(3-0) RB: (FSC 810) or food science, law, food safety, international development or related disciplines.

How Codex Alimentarius formulates and harmonizes food standards for hygiene, contaminants, food additives, veterinary drugs, and pesticide residues, including its role in the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) Agreements.

817 Animal Health, World Trade and Food Safety (OIE): Challenges and Opportunities
Fall. 3(3-0) RB: (FSC 810) or animal science, veterinary medicine, food science, law, food safety, international development, agriculture, or related disciplines.

Examines the history, objectives, rules and operations of the World Organization for Animal Health (OIE), regarding global animal health, animal welfare, world trade, and food safety.

818 Global Risk Regulation: Focus on Food Safety
Summer. 3(3-0) RB: Food science, law, food safety, animal science, veterinary medicine, international development, health, environment, or related disciplines.

Focuses on societies' efforts to assess and manage food, health, safety and environmental risks, including selection of the risks deserving regulatory attention, scientific advice and decision-making situations of scientific uncertainty, the role of non-scientific values, calculating costs and benefits of regulation, and distribution and equity effects.

823 Diet and Immune Function
Spring of odd years. 3(3-0) RB: Biocomplexity and Microbiology.

Influence of diet on the immune system and relationship to infectious and non-infectious diseases, adverse reactions such as food allergy, and alcohol and substance abuse. Methods to evaluate immune function.

831 Advanced Cereal Science
Spring of odd years. 3(3-0) RB: (BMB 401 and FSC 401) or approval of department.

Physico-chemical properties of major components in cereal grains. Relationship of constituent structures to functionality in the processing of cereal grains into food products, with emphasis on wheat.

842 Foodborne Diseases
Spring of odd years. 3(3-0) RB: FSC 440 or FSC 840

Epidemiology, isolation, characterization, clinical manifestations, pathogenicity, incidence and control of bacterial, parasitic and viral foodborne pathogens and associated toxins.

890 Special Problems in Food Science
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to graduate students in Food Science. Approval of department; application required.

Individual investigation of an area of food science.

891 Selected Topics in Food Science
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Food Science, or major or Human Nutrition major.

Topics of current interest and importance in basic and applied areas of food science.
892  **Food Science and Animal Science Seminar**  
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Animal Science. Administered by Food Science. R: Open to graduate students in the Department of Animal Science or in the Department of Food Science and Human Nutrition.  
Critical review of literature. Organization and communication of scientific data in food science and animal science.

898  **Master's Research**  
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. R: Open only to masters students in Food Science. Approval of department.  
Directed research in support of Plan B master's degree requirements.

899  **Master's Thesis Research**  
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to masters students in the Food Science major.  
Master's thesis research.

999  **Doctoral Dissertation Research**  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open to doctoral students in the Food Science major.  
Doctoral dissertation research.