338. Machinery Systems for Food Processing
Spring. 3(3-0)
P: MTH 235.
Principles of design, operation, and performance of equipment for processing raw materials into finished or intermediate products.
SA: AE 338

460. Postharvest Engineering
Fall. 3(3-0)
P: BE 350 or CHE 311 or ME 410. R: Open only to majors in College of Agriculture and Natural Resources or College of Engineering.
Engineering principles involved with the storage and handling of grains and horticultural crops between harvest and processing.

465. Thermal Processing of Foods
Spring. 3(3-0)
P: BE 350 or CHE 311 or ME 410. R: Open only to majors in College of Agriculture and Natural Resources or College of Engineering. Not open to students with credit in FE 483 or FE 433.
Engineering principles involved in the freezing, heating, cooling, drying and aseptic processing of food products.

490. Directed Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 9 credits in all enrollments for this course.
P: FSC 211 or MSM 221 or MTH 235. R: Open only to Engineering majors. Approval of department; application required.
Supervised individual student research and study in food engineering.

491. Special Topics in Food Engineering
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: FSC 211 or MSM 221 or MTH 235. R: Open only to Engineering majors. Approval of department.
Special topics in food engineering.

FOOD SCIENCE FSC

Department of Food Science
College of Agriculture and Natural Resources

150. Introduction to Nutrition and Food Science
Fall, Spring, Summer. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Human Nutrition and Foods.
Nutrition needs in life stages from a human ecological perspective. Domestic and international factors affecting the availability of a safe, nutritious food supply. Relationships of food choices to health and disease.

211. Principles of Food Science
Fall. 3(3-0)
P: CEM 141.
Scientific principles, historical perspective and current status of technology related to food composition, safety, toxicology, processing, preservation and distribution.

329. Fundamentals of Food Engineering
Spring. 3(4-0) Interdepartmental with Food Engineering. Administered by Food Engineering.
P: FSC 211, MTH 124, PHY 231. R: Not open to freshmen and sophomores.
Unit operations in food industry: fluid mechanics, heat transfer, rate processes, refrigeration, freezing, and dehydration. Thermal process calculations.

330. Food Processing: Fruits and Vegetables
Fall. 2(3-3)
P: MTH 116, FSC 211. R: Not open to freshmen.
Fruit and vegetable composition and quality indices. Harvest and post harvest technology. Preservation systems: canning, freezing and specialized techniques. Offered first half of semester.

331. Food Processing: Cereals
Fall. 2(3-3)
P: MTH 116, FSC 211. R: Not open to freshmen.
Classification and composition of cereals. Milling processes. Cereal product manufacture. Offered second half of semester.

332. Food Processing: Dairy Foods
Spring. 2(1-3)
P: MTH 116, FSC 211. R: Not open to freshmen.
Fluid milk. Principles and technology in manufacturing dairy products. Marketing, distribution and regulations of dairy foods. Offered first half of semester.

333. Food Processing: Meat, Poultry and Fishery Products
Spring. 2(1-3)
P: FSC 211, MTH 116. R: Not open to freshmen.
Manufacturing practices and principles of fresh, frozen, and cured meats, eggs, and processed products. Product formulation and quality control. Offered second half of semester.

401. Food Chemistry
Fall. 3(3-0)
P: FSC 211, CEM 251. R: Not open to freshmen and sophomores. Not open to students with credit in HNF 300.
Organic and biological reactions of food constituents. Chemical changes in foods during processing and storage affecting texture, color, flavor, stability and nutritive qualities.

402. Food Chemistry Laboratory
Fall. 1(0-3)
P: FSC 401 or concurrently. R: Open only to majors in Food Science, Foods: Technology and Management, and Food Engineering.
Chemical changes in food constituents which affect stability of food products and properties such as color, flavor and texture.

405. Application of Biotechnology to Food Science
Fall of odd-numbered years. 3(3-0)
P: MIC 205 or MIC 301.
Advances in biotechnology and their application to food safety and quality. Scientific basis and methods used in genetic engineering of plant and animal cells. Use of molecular probes in detection of toxins and bacterial pathogens. Ethical concerns related to biotechnology.

407. Food and Animal Toxicology
Fall. 3(3-0) Interdepartmental with Animal Science. Administered by Animal Science.
P: BCH 200 or BCH 401. R: Not open to freshmen and sophomores.
Fate and effects of chemicals in the food chain. Impact on animal production. Residues in food products. Food safety assessment. Control methods.

407L. Toxicology Methods Laboratory
Fall. 2(0-4) Interdepartmental with Animal Science. Administered by Animal Science.
P: ANS 407 or concurrently. R: Not open to freshmen and sophomores.
Laboratory techniques for evaluating potential toxicity of chemicals to living systems. Field trip to industrial toxicology laboratory required.

417. Topics in Toxicology
Spring. 1(1-0) Interdepartmental with Animal Science. Administered by Animal Science.
P: ANS 407. R: Not open to freshmen and sophomores.
Selected topics including regulatory toxicology, risk assessment, environmental toxicology, food safety, and safe handling of toxic substances.

420. Quality Assurance
Fall. 2(2-0)
P: STT 201; FSC 330 or FSC 331 or FSC 332 or FSC 333. R: Not open to freshmen and sophomores.
Theory and application of quality assurance programs for food processing industries.

421. Food Laws and Regulations
Spring. 3(3-0)
P: HNF 150 or HNF 311 or FSC 211. R: Not open to freshmen and sophomores.
Adoption, interpretation and enforcement of laws and regulations governing food processing and foodservice systems. Impact of regulation on food production, availability, marketing and safety.

432. Advanced Food Processing: Dairy Foods
Fall of odd-numbered years. 3(2-3)
P: FSC 332. R: Not open to freshmen and sophomores.
Theoretical and practical principles of the manufacture of cheese, frozen desserts, butter and powders. Concentration and fractionation techniques for producing dairy based ingredients for food systems.

433. Advanced Food Processing: Meat, Poultry and Fish
Fall of even-numbered years. 3(2-3)
P: FSC 333. R: Not open to freshmen and sophomores.
Scientific principles of processing animal tissues for food. Field trips required.

440. Food Microbiology
Spring. 3(3-0) Interdepartmental with Microbiology.
P: MIC 205. R: Not open to freshmen and sophomores.
Major groups of microorganisms of importance to the food industry. Emphasis on ecological, physiological, and public health aspects.

441. Food Microbiology Laboratory
Spring. 1(0-3) Interdepartmental with Microbiology.
P: FSC 440 or concurrently; MIC 206. R: Not open to freshmen and sophomores. Open only to majors in Food Engineering, Food Science, Foods: Technology and Management, or Microbiology and Public Health.
Methods for studying major groups of microorganisms important to food industry. Isolation, enumeration, characterization, identification and use of microorganisms.

455. Food Analysis
Fall. 3(2-3)
P: BCH 200, CEM 262, FSC 401. R: Not open to freshmen and sophomores.
Principles and application of analytical techniques. Analysis for fats, proteins, carbohydrates, minerals, vitamins and additives. Techniques include spectroscopy, fluorimetry, chromatography, electrophoresis, proximate composition.

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 freshmen and sophomores. Approval of department; application required.
Individual study of selected topics in food science. Supervised independent study.

492. Senior Seminar in Food Science
Spring. 1(1-0)
R: Open only to seniors in Food Science.
Critical study and discussion of contemporary issues related to the food industry.

801. Chemistry of Food Lipids
Fall of odd-numbered years. 3(3-0)
P: FSC 401, BCH 461.
Composition and structure of lipids: physical and chemical properties in relation to their function in foods.

802. Food Proteins
Spring of odd-numbered years. 3(3-0)
P: BCH 461, FSC 401.
Use of proteins and enzymes in the food industry. Functional properties of proteins and enzymes in food systems.

807. Advanced Food Toxicology
Fall of even-numbered years. 3(3-0) Interdepartmental with Animal Science.
R: Approval of department.
Toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, and chemical carcinogenesis. Risk assessment.

833. Muscle and Meat Biochemistry
Spring of odd-numbered years. 3(3-0)
P: BCH 452 or concurrently.
Anatomical, physiological, and biochemical properties of muscle. Structure and function of muscle proteins. Regulation of muscle contraction. Post mortem biochemical changes and meat protein functionality.

837. Rheological Methods in Food Processing Engineering
Fall. 3(3-0) Interdepartmental with Agricultural Engineering. Administered by Agricultural Engineering.
Definition, analysis, and measurement of rheological properties to describe the steady shear, dynamic, viscoelastic, extensional, and solid behavior of biological materials. Industrial applications of rheological methods with emphasis on fluid and semi-solid foods.

840. Advanced Food Microbiology
Spring of odd-numbered years. 3(3-0)
P: FSC 440.
Detection, characterization, identification, and enumeration of food-associated pathogens. Applications and regulation of food biotechnology.

850. Analytical Techniques in Food Science
Summer of odd-numbered years. 2(1-2)
R: Open only to graduate students in Food Science or Human Nutrition.
Theory and application of dynamic rheological testing, nucleic acid and protein analysis, and immunological techniques. Other new technologies related to food science.

860. Research in Food Processing Technology
Summer of even-numbered years. 2(1-2)
R: Open only to graduate students in Food Science, Human Nutrition, Animal Science, and Horticulture.
Theory, application, and evaluation of food processing technology: ultrafiltration, food irradiation, and critical point extraction.

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 Foods or Food Science or Human Nutrition.
Topics of current interest and importance in basic and applied areas of food science.

892. Food Science Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course.
R: Open only to graduate students in Food Science.
Critical review of literature. Organization and communication of scientific data in food 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 graduate 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 M.S. students in Food Science.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to Ph.D. students in Food Science.

FOOD SYSTEMS ECONOMICS AND MANAGEMENT — FSM

Department of Agricultural Economics
College of Agriculture and Natural Resources

200. Introduction to Food Systems Management
Fall. 3(3-0)
Organization and operation of the industrialized food system: agricultural production, food processing, manufacturing, wholesaling, retailing and consumption. Application of economic and management principles to firms and the overall food system.

310. Livestock and Product Marketing
Fall. 3(2-2) Interdepartmental with Animal Science. Administered by Animal Science.
P: ANS 112. R: Not open to freshmen.
Movement of livestock and products into and through market channels. Market structures, futures, options. Current issues. Field trip required.

320. Agribusiness and Food Sales
Spring. 3(3-0)
P: FSM 200 or ML 300. R: Not open to freshmen and sophomores.
Selling processes and activities within agribusiness and food firms. Principles and techniques of sales. Operation of sales organizations.

325. Agribusiness Labor and Personnel Management
Fall. 3(3-0)
P: FSM 200 or MGT 302 or concurrently. R: Not open to freshmen and sophomores.
Labor for farms and agribusinesses: planning, recruiting, training, scheduling, motivating, supervising, and evaluating. Labor regulations, compensation, and records.

330. Farm Business Management
Spring. 3(4-0)
P: FSM 200 or MGT 302. R: Not open to freshmen.
Management, planning, and control of farm production, marketing and financial activities. Problems and evaluation of alternative solutions. Economic principles, budgeting, financial statements.

335. Food Marketing Management
Spring. 3(3-0) Interdepartmental with Marketing and Logistics. Administered by Marketing and Logistics.
P: FSM 200 or ML 300. R: Open only to juniors and seniors in College of Business and in programs for which ML 335 is a catalog-listed requirement.
Management decision-making in food industry organizations (processors, wholesalers, retailers). Marketing and sales in response to customer and consumer needs. Distribution and merchandising systems in domestic and international contexts.

412. Financial Management in the Food System
Spring. 3(3-0)
P: FSM 330, FI 311. R: Not open to freshmen and sophomores.
Analysis of agricultural business performance using financial statements. Capital budgeting of durable investments. Risk. Alternative methods to control capital asset services. Financial markets and credit institutions affecting agriculture.

421. Public Policy Issues in Food and Agribusiness
Spring. 3(3-0)
P: EC 201, FSM 200. R: Not open to freshmen and sophomores.
Objectives, rationale, and consequences of public policy for food and agriculture. Analysis of economic implications for food and agribusinesses, farmers, consumers, and society.

429. Agribusiness Management
Spring. 3(4-0)
P: FSM 330. R: Open only to seniors and graduate students.
Analysis of agribusiness management functions including planning, organizing, and controlling. Integration of production, marketing, and financial aspects of agribusiness. Solutions to agribusiness managerial problems.

439. Food Business Analysis and Strategic Planning
Fall. 3(3-0) Interdepartmental with Marketing and Logistics. Administered by Marketing and Logistics.
P: ML 335 or FSM 335; STT 201 or STT 200 or STT 315. R: Open only to juniors and seniors in College of Business and in programs for which MTA 439 is catalog-listed requirement.
Principles and techniques of business analysis and strategic planning applied to food firms. Food trend forecasts, market potential, competition and cost analyses, business and strategic planning.