

## Descriptions—Fisheries and Wildlife of Courses

### 854. Adaptive Management of Natural Resource Systems

Fall of odd years. 3(2-2) P: (ZOL 355) and (FW 434)

Principles and practices of adaptive environmental assessment and management. Applications to ecosystem and natural resource management.

### 860. Wildlife Nutrition

Fall of odd years. 3(2-2) R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, and Natural Science.

Nutritional ecology of wild species. Techniques for analyzing and improving nutritional qualities.

### 872. Fishery Habitat Analysis and Management

Spring of odd years. 3(3-0) R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, Engineering, and Natural Science.

Fish habitat use. Analysis and manipulation of habitats to enhance fish production in freshwater ecosystems.

### 873. Plankton Biology

Spring of even years. 4(3-3) P: (FW 472)

Biology of plankton organisms in freshwater and marine systems. Field and laboratory methods. Individual research projects. Field trips required.

### 874. Advanced Fisheries Ecology and Food Web Management

Spring of odd years. 3(3-0) P: (ZOL 355) and (FW 472) and (FW 479)

Application of food web theory to fisheries management. Evaluation of abiotic and biotic mechanisms as they affect aquatic community structure and food web dynamics.

### 875. Advanced Aquaculture

Fall of odd years. 3(3-0) P: FW 475.

Adaptations and responses of aquatic organisms to environmental change in aquaculture systems. Research methods and applications for aquaculture planning and management decisions.

### 877. Fish Population Dynamics

Fall of even years. 3(2-2) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Natural Science.

Quantitative analysis of fish populations. Evaluation, causes, and impacts of the rates of change in survival, growth, reproduction, and recruitment for fish populations and their yield.

### 879. Advanced Limnology

Spring of even years. 3(3-0) P: (FW 472 or ZOL 431)

Theory and management of streams, rivers, lakes, reservoirs, and other deepwater habitats from ecosystem and landscape perspectives.

### 891. Advanced Topics

Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 10 credits in all enrollments for this course.

In depth study of advanced topics in fisheries and wildlife.

### 892. Biodiversity

Spring. 2(2-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Zoology. Administered by Zoology. P: ZOL 250.

Status of world biota and factors in the decline and extinction of major groups of plants and animals. Theory and design of natural reserves. Assessment and ecological meaning of diversity. Management for global and local diversity.

### 893. Seminar in Fisheries and Wildlife

Fall, Spring. 1(1-0) A student may earn a maximum of 7 credits in all enrollments for this course. Study and research in advanced problems and current development in fisheries and wildlife.

### 897. Community and Ecosystem Ecology

Spring. 4(4-0) Interdepartmental with Zoology; and Botany and Plant Pathology. Administered by Zoology.

Structure and function of natural communities and ecosystems. Community analysis along environmental gradients. Succession, food web analysis, energy flow, nutrient cycling, and effects of human activities on ecosystems.

### 898. Master's Research

Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 10 credits in all enrollments for this course. R: Open only to graduate students in Fisheries and Wildlife.

Master's degree Plan B research paper.

### 899. Master's Thesis Research

Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to graduate students in Fisheries and Wildlife.

### 943. Techniques of Analyzing Unbalanced Research Data

Spring. 4(4-0) Interdepartmental with Animal Science; Crop and Soil Sciences; Forestry; and Horticulture. Administered by Animal Science. P: STT 464. R: Open only to graduate students in the College of Agriculture and Natural Resources.

Linear model techniques to analyze research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Estimable comparisons. Hypothesis testing. Computational strategies. Variance and covariance components. Breeding values.

### 976. Multivariate Methods in Agriculture and Natural Resources

Spring. 4(4-0) Interdepartmental with Forestry; and Animal Science. Administered by Forestry. P: STT 422, MTH 314. R: Open only to graduate students in the College of Agriculture and Natural Resources and in the Interdepartmental Graduate Specializations in Ecology and Evolutionary Biology.

Application of multivariate methods to research problems. Hotelling's T-test, profile analysis, discriminant analysis, canonical correlation, principal components, principal coordinates, correspondence analysis, and cluster analysis.

### 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 Doctoral level graduate students in Fisheries and Wildlife.

## FOOD SCIENCE

## FSC

### Department of Food Science and Human Nutrition College of Agriculture and Natural Resources College of Human Ecology

### 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) Not open to students with credit in FSC 299.

Scientific principles, historical perspective, and current status of technology related to food composition, safety, toxicology, processing, preservation, and distribution.

### 229. Unit Operations in Food Processing

Fall. 3(3-0)

Principles, technologies, and applications involved in conversion of raw products into high quality foods. Processing principles such as thermal processing, irradiation, freezing, membrane concentration, enzyme technologies, dehydration, and refrigeration.

### 275. Seafood Systems Management

Spring. 3 credits. Interdepartmental with Animal Science; and Fisheries and Wildlife. Administered by Fisheries and Wildlife.

Domestic and international perspectives on major aquatic foods. Cultural and nutritional value; wild harvest; aquaculture; processing technology; food handling and food safety.

### 320. Muscle Foods

Spring. 3(2-3) Interdepartmental with Animal Science. Administered by Animal Science. P: (ANS 210 or FSC 211 or HNF 150)

Structure of muscle. Meat technology and merchandising concepts.

### 329. Fundamentals of Food Engineering

Spring. 3(3-0) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. P: FSC 211, MTH 124, PHY 231. R: Not open to freshmen or sophomores.

Unit operations in food industry: fluid mechanics, heat transfer, rate processes, refrigeration, freezing, and dehydration. Thermal process calculations.

SA: FE 329

### 339. Food Processing and Engineering Laboratory

Spring. 2(0-6) P: (FSC 329 or concurrently) and completion of Tier I writing requirement. (FSC 229)

Application of principles of material and energy balance, fluid flow, heat transfer, and water activity to the batch and continuous processing of raw product into high quality food.

**401. Food Chemistry**

*Fall. 3(3-0) P: (BCH 200 or CEM 352) or (BCH 401 or concurrently) R: Not open to freshmen or sophomores.*

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) and completion of Tier I writing requirement.*

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 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 200 or STT 201 or STT 231 or STT 315 or STT 351) and (FSC 229 or concurrently or ANS 210 or concurrently or HRT 203 or concurrently or FSC 211 or concurrently) R: Open only to juniors or seniors or graduate students in the Department of Food Science and Human Nutrition or in the Food Processing and Technology Specialization.*

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 or FSC 229 or FSM 200)*

Adoption, interpretation, and enforcement of laws and regulations governing food processing and foodservice systems. Impact of regulation on food production, availability, marketing, and safety.

**430. Food Processing: Fruits and Vegetables**

*Fall. 3(2-3) P: (FSC 211 or FSC 229) R: Not open to freshmen or sophomores.*

Fruit and vegetable composition and quality indices. Harvest technology, postharvest physiology, and preparatory systems. Principles and applications of thermal processing, freezing, and specialized techniques.

SA: FSC 330

**431. Food Processing: Cereals**

*Fall. 3(2-3) P: (FSC 211 or FSC 229) R: Not open to freshmen or sophomores.*

Classification and composition of cereals. Milling processes. Cereal product manufacture.

SA: FSC 331

**432. Food Processing: Dairy Foods**

*Spring. 3(2-3) P: (FSC 211 or FSC 229 or ANS 210) R: Not open to freshmen or sophomores.*

Principles for production and processing of safe and wholesome dairy foods. Practical experience in safety and quality assurance systems and in the processing of fluid milk, cultured products, cheese, and frozen desserts.

SA: FSC 332

**433. Food Processing: Muscle Foods**

*Fall. 3(2-3) P: (FSC 211 or FSC 229 or ANS 210) R: Not open to freshmen or sophomores.*

Manufacturing practices and principles of fresh, frozen, and cured meats and fish. Processed products from muscle foods. Egg characteristics. Product formulation and quality control.

SA: FSC 333

**440. Food Microbiology**

*Spring. 3(3-0) Interdepartmental with Microbiology. P: (MIC 205 or MIC 301) and completion of Tier I writing requirement. R: Not open to freshmen or sophomores.*

Major groups of microorganisms of importance to the food industry. Emphasis on ecological, physiological, and public health aspects.

SA: MPH 440

**441. Food Microbiology Laboratory**

*Spring. 2(0-4) Interdepartmental with Microbiology. P: (FSC 440 or concurrently) and completion of Tier I writing requirement. (MIC 206 or MIC 302)*

Methods for studying major groups of microorganisms important to the food industry. Isolation, enumeration, characterization, identification, and use of microorganisms.

SA: MPH 441

**455. Food Analysis**

*Fall. 3(2-3) P: (BCH 200) or (BCH 401 or concurrently) and completion of Tier I writing requirement.*

Principles and application of analytical techniques. Analysis for fats, proteins, carbohydrates, minerals, vitamins, and additives. Techniques include spectroscopy, fluorimetry, chromatography, electrophoresis, and proximate composition.

**470. Integrated Approaches to Food Product Development**

*Fall, Spring. 2(0-6) P: (FSC 402 or concurrently or FSC 441 or concurrently or FSC 455 or concurrently) (FSC 339) and completion of Tier I writing requirement. R: Open only to seniors or graduate students.*

Food product development including obtaining, screening, and selection of ideas. Integration of food processing, chemistry, analysis, and microbiology for the design, production, and evaluation of a food product.

**477. Food Engineering**

*Fall. 3(2-2) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. P: (BE 350 and CE 321)*

Unit operations, process engineering, equipment, and industrial practices of the food industry. Emphasis on manufactured dairy products: thermal processing, pipeline design, heat exchange, evaporation, dehydration, aseptic processing, membrane separation, cleaning, and sanitation.

SA: FE 465

**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 or sophomores. Approval of department; application required.*

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

**801. Chemistry of Food Lipids**

*Fall of odd 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 even years. 3(3-0) P: (BCH 461 and 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 years. 3(3-0) Interdepartmental with Animal Science; and Human Nutrition and Foods. R: Approval of department.*

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

**831. Advanced Cereal Science**

*Fall of even years. 3(3-0) P: BCH 401, FSC 331, FSC 401 or approval of department.*

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

**833. Muscle and Meat Biochemistry**

*Spring of odd years. 3(3-0) P: (BCH 461 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.

## Descriptions—Food Science of Courses

### 837. Food Rheology

Fall. 3 credits. Interdepartmental with Biosystems Engineering. Administered by Biosystems 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 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 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 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.

### 320. Agribusiness and Food Sales (W)

Spring. 3(3-0) P: FSM 200 or MSC 300. R: Not open to freshmen and sophomores. Completion of Tier I writing requirement.

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 Supply Chain Management. Administered by Marketing and Supply Chain Management. P: (FSM 200 or MSC 300) R: Open only to juniors or seniors.

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. SA: ML 335, MTA 335

### 412. Financial Management in the Food System

Spring. 3(3-0) P: ACC 201 or ACC 230 R: Not open to freshmen or 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 (W)

Spring. 3(4-0) P: FSM 330. R: Open only to seniors and graduate students. Completion of Tier I writing requirement.

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 Supply Chain Management. Administered by Marketing and Supply Chain Management. P: (MSC 335 or FSM 335) and (STT 201 or STT 200 or STT 315) R: Open only to juniors or seniors.

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.

SA: ML 439, MTA 439

### 441. Commodity and Futures Marketing

Spring. 3(3-0) P: FSM 200, EC 201; STT 200 or STT 201 or STT 315. R: Not open to freshmen and sophomores.

Supply, demand and prices in commodity markets. Futures and options and their role in forward pricing. Agricultural and food markets.

### 443. Food Industry and Cooperative Marketing

Spring. 3(3-0) P: FSM 200. R: Not open to freshmen and sophomores.

Multiple firm and cooperative marketing methods. Organization and operation of cooperatives, marketing orders, trade associations and other forms of group action in the food system.

### 462. Agricultural Development in Less Developed Countries

Fall. 3(3-0) Interdepartmental with Public Resource Management. P: EC 201; PRM 260 recommended. R: Not open to freshmen and sophomores. Factors responsible for agricultural growth, as well as technical and institutional change. Sustainable strategies for increasing food production and rural incomes.