

**Descriptions—Fisheries and Wildlife
of
Courses**

471. Ichthyology
Fall. 3(2-3) Interdepartmental with Zoology.
P: ZOL 228.
Fish morphology, physiology. Development, behavior, evolution and ecology. World fishes with emphasis on freshwater fishes.
QP: FW 301, ZOL 307, ZOL 428 QA: FW 471, ZOL 471

472. Limnology
Fall. 3(3-0) Interdepartmental with Zoology.
P: CEM 141, ZOL 250. R: Not open to students with credit in ZOL 431.
Ecology of lakes with emphasis on interacting physical, chemical, and biological factors affecting their structure and function.
QP: CEM 141, ZOL 389 QA: FW 476

474. Fishery and Limnological Techniques
Fall. 3(1-6) Interdepartmental with Zoology.
P: FW 472 or concurrently.
Field and laboratory investigations of physical, chemical, and biological parameters of lakes and streams.
QP: FW 476 QA: FW 477, FW 473

475. Aquaculture
Spring. 3(3-0)
P: ANS 313 or FW 364 or ZOL 250.
Propagation and rearing of aquatic organisms used for food, bait and recreational fisheries management. Culture principles and techniques for important aquatic species. Commercial potential.
QP: ANS 313A, ANS 313B or FW 302 or ZOL 389 QA: FW 475

479. Fisheries Management
Spring. 3(2-2)
P: FW 424, FW 471, FW 474.
Manipulation of aquatic populations and their habitats to achieve societal goals for fishery resources. Management of human impact and biotic diversity.
QP: FW 471 QA: FW 473

484. Environmental Education
Spring. 3(3-0)
P: AEE 101 or PRR 320 or RD 201 or TE 150. R: Not open to freshmen and sophomores.
Methods, materials and theory for teaching environmental education in formal and nonformal educational settings.
QP: RD 301 or PRR 320 QA: FW 484

490. Independent Studies of Fisheries and Wildlife Problems
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
P: BS 110. R: Not open to freshmen and sophomores. Approval of department and application required.
Special topics in fisheries and wildlife.
QP: BS 212 QA: FW 404

810. Human Dimensions Research in Fisheries and Wildlife
Fall of even-numbered years. 3(3-0)
Methods of surveying, educating and involving the public to achieve fish and wildlife management goals. Review of human dimensions research and current case studies.
QA: FW 810

814. Environmental Chemodynamics
Fall. 4(4-0)
R: Open only to graduate students in College of Agriculture and Natural Resources, College of Engineering, College of Human Medicine, College of Natural Science, College of Osteopathic Medicine, or College of Veterinary Medicine.
Chemical and environmental factors controlling the distribution of organic and inorganic chemicals in air, water and soil. Monitoring.
QA: FW 802

824. Analysis of Wildlife Populations
Spring of odd-numbered years. 3(2-3)
Statistical and ecological concepts, methods and computer techniques needed to analyze and interpret demographic data from fish and wildlife studies.
QP: STT 421

826. Ecology and Management of Waterfowl
Fall of even-numbered years. 3(2-3)
P: FW 412, FW 424.
Physiological, behavioral, and population characteristics of waterfowl. Current issues and management.
QP: FW 412, FW 424 QA: FW 826

828. Conservation and Genetics
Fall of odd-numbered years. 3(3-0)
P: ZOL 341 or CSS 350 or ANS 314.
Population genetic principles applied to ecology and management of fish and wildlife.
QP: ZOL 441 or CSS 350 or ANS 314 QA: FW 828

831. Aquatic Toxicology
Spring of even-numbered years. 4(3-2)
R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, Engineering, Human Medicine, Natural Science, Osteopathic Medicine, and Veterinary Medicine.
Techniques for assessing acute and chronic effects of toxicants on biochemical, physiological, organismal, population, community and ecosystem levels of organization.
QA: FW 831

860. Wildlife Nutrition
Fall of odd-numbered 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.
QA: FW 860

872. Fishery Habitat Analysis and Management
Spring of even-numbered 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.
QA: FW 872

875. Advanced Aquaculture
Fall of odd-numbered years. 3(3-0)
P: FW 475. R: Open only to seniors and graduate students.
Adaptations and responses of aquatic organisms to environmental change in aquaculture systems. Research methods and applications for aquaculture planning and management decisions.
QP: FW 475

876. Applied Limnology
Spring of odd-numbered years. 3(3-0)
R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, Engineering, and Natural Science.
Applied aquatic ecology. Quantitative relationships between physical, chemical, and biological parameters in polluted and unpolluted lakes.
QA: FW 876

877. Fish Population Dynamics
Fall of even-numbered years. 3(3-0)
R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, and 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.
QA: FW 877

878. Dynamics of Trace Contaminants in Aquatic Systems
Spring of odd-numbered years. 5(3-4)
R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, Engineering, Human Medicine, Natural Science, Osteopathic Medicine, and Veterinary Medicine.
Chemical and environmental parameters controlling movement and disposition in aquatic environments. Fate models.
QA: FW 878

879. Advanced Limnology
Spring of even-numbered years. 3(3-0)
R: Open only to graduate students in the Colleges of Agriculture and Natural Resources, Engineering, and Natural Science.
Physical, chemical, and biological processes affecting productivity of aquatic ecosystems.
QP: FW 477 QA: FW 874, FW 875

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.
QA: FW 802

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.
QA: FW 801

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.

QA: FW 899

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.

QA: FW 999

FOOD ENGINEERING FE

**Department of Agricultural
Engineering
College of Agriculture and Natural
Resources
College of Engineering**

329. Fundamentals of Food Engineering
Spring. 3(4-0) Interdepartmental with Food Science.
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.
QP: PHY 237, FSC 211, MTH 109 or MTH 111 QA: ATM 329, FSC 430

381. Food Process Engineering I
Fall. 3(3-0)
P: CHE 311 or CE 321 or ME 332. R: Open only to majors in College of Engineering.
Rheological behavior of fluid and semi-solid foods. Applications in mixing, pipeline design, extrusion, calendaring, and coating.
QP: MTH 310, CHE 340 or CE 321 or ME 332 QA: FE 475

433. Food Dehydration
Spring. 3(3-0)
P: CHE 321 or ME 410. R: Open only to majors in College of Engineering.
Dehydration of food and agricultural products. Bin, belt, rotary, spray, microwave, and solar drying of food products.
QP: AE 352, CHE 343 QA: F E 433

- 483. Food Process Engineering II**
Fall. 3(3-0)
P: CHE 321 or concurrently; CEM 362 or concurrently; FE 381 or concurrently; MPH 205. R: Open only to students in the College of Engineering.
Kinetics of biological and food reactions. Design and analysis of biological reactors. Thermal processing, microbial death kinetics, sterilization, and pasteurization. Aseptic processing. Thermal process evaluation.
QP: CHE 341, FE 475, CEM 363, MPH 200 QA: FE 477
- 485. Food Process Engineering III**
Fall. 3(3-0)
P: FE 381; FE 483 or concurrently or ME 410. R: Open only to majors in College of Engineering.
Diffusion, mass transfer coefficients, separations, freezing, dehydration, process integration, and design concepts.
QP: FCE 475 or ME 411 QA: FE 473
- 487. Food Engineering Design Project**
Spring. 4(2-14)
P: FE 483, FE 485. R: Open only to seniors and graduate students in Food Engineering.
Process analysis and modification. Feasibility. Food industry regulations. Case histories from food, pharmaceutical, and bioprocess industries.
QP: AE 486, FE 477 QA: F E 487
- 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.
QP: MTH 310 or FSC 241 QA: FE 480
- 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.
QA: F E 490

FOOD SCIENCE FSC

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

- 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.
QP: CEM 141B QA: FSC 211
- 330. Food Processing: Fruits and Vegetables**
Fall. 2(3-13)
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.
QP: MTH 108, MTH 109 or MTH 111, FSC 211 QA: FSC 460
- 331. Food Processing: Cereals**
Fall. 2(3-13)
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.
QP: FSC 211, MTH 108, MTH 109 or MTH 111 QA: FSC 470
- 332. Food Processing: Dairy Foods**
Spring. 2(1-13)
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.
QP: MTH 108, MTH 109 or MTH 111, FSC 211 QA: FSC 400, FSC 405

- 333. Food Processing: Meat, Poultry and Fishery Products**
Spring. 2(1-13)
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.
QP: MTH 108, MTH 109 or MTH 111, FSC 211 QA: FSC 445
- 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.
Chemical properties of food constituents. Chemical changes in foods during processing and storage affecting texture, color, flavor, stability, and nutritive quality.
QP: FSC 211, CEM 241 QA: FSC 333, FSC 402
- 402. Food Chemistry Laboratory**
Fall. 1(0-13)
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.
QP: FSC 333 QA: FSC 333L
- 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.
QP: STT 201, FSC 330 QA: FSC 457
- 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.
QP: HNF 102 or FSC 211 or HNF 411 QA: FSC 205
- 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.
QP: FSC 400 QA: FSC 405
- 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.
QP: FSC 345 QA: FSC 445
- 440. Food Microbiology**
Spring. 3(3-0) Interdepartmental with Microbiology.
P: MPH 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.
QP: MPH 200 or MPH 301 QA: FSC 440 or MPH 440
- 441. Food Microbiology Laboratory**
Spring. 1(0-3) Interdepartmental with Microbiology.
P: FSC 440 or concurrently; MPH 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.
QP: FSC 440 QA: FSC 441 or MPH 441

- 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.
QP: CEM 162, CEM 241, FSC 333 QA: FSC 455, FSC 456
- 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.
QA: FSC 480
- 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.
QA: FSC 490
- 801. Chemistry of Food Lipids**
Spring of even-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.
QP: FSC 333, FSC 333L, BCH 463 QA: FSC 952
- 802. Food Proteins**
Fall of even-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.
QP: BCH 452, FSC 333
- 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 even-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.
QP: BCH 453 QA: FSC 951
- 840. Advanced Food Microbiology**
Spring of even-numbered years. 3(3-0)
P: FSC 440.
Detection, characterization, identification, and enumeration of food-associated pathogens. Applications and regulation of food biotechnology.
QP: FSC 440 QA: FSC 832
- 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.