

- 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.

**Descriptions—Food Science
of
Courses**

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.
QA: FSC 880

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.
QA: FSC 850

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.
QA: FSC 990

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.
QA: FSC 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 Ph.D. students in Food Science.
QA: FSC 999

**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.
QA: FSM 200

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.
QP: FSM 200, ML 300

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.
QP: FSM 200 or MGT 302

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.
QP: FSM 200 QA: FSM 330, FSM 430

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.
QP: FSM 330 QA: FSM 412, FSM 430

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.
QP: EC 201, FSM 200 QA: FSM 421

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.
QP: FSM 200

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.
QP: STT 201, EC 201, FSM 200 QA: FSM 441

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.
QP: FSM 200 QA: FSM 443

462. Agricultural Development in Less Developed Countries
Fall. 3(3-0)
P: EC 201; PAM 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.
QP: EC 201 QA: FSM 462

490. Independent and Supervised Study
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 7 credits in all enrollments for this course.
P: FSM 200; ML 335 or FSM 330. R: Open only to FSM majors. Approval of department; application required. In-depth independent study of topics and issues affecting the food system. Complementary to previous coursework, adapted to career aspirations.
QP: FSM 200, FSM 335 or FSM 330 QA: FSM 480

FORESTRY FOR

**Department of Forestry
College of Agriculture and Natural
Resources**

201. Tenets of Forestry
Fall. 1(1-0)
R: Open only to Forestry students. Completion of Tier I writing requirement. History, founding principles, and core concepts of forestry. Stewardship, conservation, professional ethics, and current forestry issues.

202. Introduction to Forestry
Fall, Spring. 3(3-0)
Historical development of forestry. Forest growth, protection, management, and products. Relationship of national and world economy and policy to forestry. Emphasis on multiple uses of forests.
QA: FOR 202

204. Forest Vegetation
Fall. 4(3-3)
Nomenclature, classification, and identification of woody plants. Tree structure as it relates to growth and ecosystem dynamics.

220. Plants and Their Environment
Fall. 3(3-0)
Relationships between plants and fundamental climatic, edaphic, and biotic factors. Structure and function of different ecosystems in relation to environmental factors.

304. Wood Technology
Fall. 4(3-2)
P: CEM 141, PHY 231. R: Not open to freshmen and sophomores. Structure and identification of wood. Physical and mechanical characteristics. Major industrial timber utilization processes including manufacture of lumber, furniture, composites, and paper.
QP: PHY 237, CEM 141, MTH 111 QA: FOR 209, FOR 430, FOR 431

306. Forest Biometry
Spring. 4(3-2)
P: MTH 116, FOR 201, FOR 204. R: Not open to freshmen and sophomores. Describing location and area of forest resources. Quantification of site, stand, and tree characteristics. Sampling and inventory. Predicting growth and yield.
QP: MTH 111, FOR 204 QA: FOR 320, FOR 420

404. Forest and Agricultural Ecology
Fall. 4(3-3) Interdepartmental with Crop and Soil Sciences.
P: CSS 210, BOT 105. Structure and function of ecosystems managed for crop and wood production. Productivity, nutrient cycling, community dynamics as affected by management intensity and natural disturbance. Dynamics of managed versus natural ecosystems.
QA: FOR 304, CSS 412

406. Silviculture
Spring. 4(3-3)
P: CSS 210, FOR 204. R: Not open to freshmen and sophomores. Ecophysiology of tree growth and reproduction. Stand structure, composition and growth. Intermediate stand treatments. Natural and artificial reproduction. Silvicultural techniques.
QP: FOR 204, CSS 210 QA: FOR 305

408. Forest Management
Fall. 4(3-2)
P: FOR 420. Management of forests for timber production in a multiple-use context. Yield projections, harvest scheduling, management prescriptions, project analysis and administration.
QP: FOR 305, FOR 455 QA: FOR 458