485. Food Process Engineering II
Fall (3-0)
P: CHE 321 or concurrently; CEM 362 or concurrently; MTH 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. Aesthetic processing. Thermal process evaluation. QP: CHE 341, FE 475, CEM 365, MTH 200 QA: FE 477

486. Food Process Engineering III
Fall (3-0)
P: FE 381; FE 381 or concurrently or ME 410. R: Open only to majors in College of Engineering. Diffusion, mass transfer coefficients, separations, freezing, dehydropization, process integration, and design concepts. QP: FE 476 or ME 411 QA: FE 473

487. Food Engineering Design Project
Spring (4-0)

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: P 480

FOOD SCIENCE
FSC
Department of Food Science and Human Nutrition
College of Agriculture and Natural Resources

211. Principles of Food Science
Fall (3-0)
P: CEM 141

330. Food Processing: Fruits and Vegetables
Fall (3-1-13)

331. Food Processing: Cereals
Fall (2-3-13)

332. Food Processing: Dairy Foods
Spring (2-1-13)

333. Food Processing: Meat, Poultry and Fishery Products
Spring (2-1-13)
P: FSC 211, MTH 118. R: Not open to freshmen. Manufacturing practices and principles of fresh, frozen, and cured meats, eggs, and processed products. Product formulation and quality control. QP: MTH 108, MTH 109 or MTH 111, FSC 211 QA: FSC 445

401. Food Chemistry
Fall (3-0)
P: FSC 211, MTH 235. 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 nutritional quality. QP: MTH 108, MTH 109 or MTH 111, FSC 211 QA: FSC 333, FSC 402

402. Food Chemistry Laboratory
Fall (2-1-13)
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 QA: FSC 330

421. Food Laws and Regulations
Fall (2-1-13)
P: HNF 150 or HNF 311 or FSC 351 or FSC 332 or FSC 353. R: Not open to freshmen and sophomores. Adaption, 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 HNF 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 processing dairy beverages. 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 tissue for food. Field trip required. QP: FSC 345 QA: FSC 445

440. Food Microbiology
Spring (3-0) Interdepartmental with Microbiology.
P: MPH 200. 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 200. R: Not open to freshmen and sophomores. Open only to majors in Food Engineering, Food Science, Foods: Technology and Management, and Microbiology and Public Health. Methods for isolation and study of 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)

490. Special Problems in Food Science
Fall, Spring. Summer. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course.
P: Not open to freshmen and sophomores. Approval of department; application required. Individual study of selected topics in food science. Supervised independent study.
QP: FSC 480

492. Senior Seminar in Food Science
Spring (1-0)
P: Open only to seniors in Food Science. Critical study and discussion of contemporary issues related to the food industry. QP: FSC 490

801. Chemistry of Food Lipids
Spring of even-numbered years. 3(3-0)
P: FSC 401, BCH 461

802. Food Proteins
Spring of even-numbered years. 3(3-0)
P: BCH 461, FSC 401

807. Advanced Food Toxicology
Fall of even-numbered years. 3(3-0) Interdepartmental with Animal Science.
P: 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 MPH 211

843. Food Microbiology
Spring of even-numbered years. 3(3-0)
QP: FSC 440 QA: FSC 832

850. Analytical Techniques in Food Science
Spring of even-numbered years. 3(3-0) Summer of odd-numbered years. 2(1-2)
P: 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 odd-numbered years. 3(3-0) Summer of even-numbered years. 3(3-0)
P: Open only to graduate students in Food Science, Human Nutrition, Animal Science, and Horticulture. Theory, application, and evaluation of food processing technologies: ultrasonics, 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 950

891. Topics of Science R:

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 899

893. 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.

894. 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

895. 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 FSC
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: FSC 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. QF: FSM 200, ML 300

325. Agribusiness Labor and Personnel Management
Fall, Spring. 3(3-0) P: FSM 200 or MGT 302 or concurrently. R: Not open to freshmen and sophomores. Labor force and agribusinesses: planning, recruiting, training, scheduling, motivating, supervising, and evaluating. Labor regulations, compensation, and records. QF: 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. QF: FSM 200 QA: FSM 340, FSC 430

412. Financial Management in the Food System

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. QF: EC 201, FSM 200 QA: FSC 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 agribusinesses. Solutions to agribusiness management problems. QF: FSM 200

441. Commodity and Futures Marketing
Spring. 3(3-0) P: FSM 200, EC 201; 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. QF: STT 201, EC 201, FSM 200 QA: FSC 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. QF: FSM 200 QA: FSC 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. QF: EC 201 QA: FSC 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. QF: FSM 200, FSM 340 or FSM 330 QA: FSC 490

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 1 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(3-0-0) 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

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

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

230. Wood Technology
Fall. 4(3-2) P: CEM 111, 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. QF: PHY 227, CEM 111, MTH 111 QA: FOR 228, FOR 400, FOR 431

236. Forest Biometry
Spring. 4(3-2) P: MTH 211, 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. QF: 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, conserving 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, 300-year and growth, intermediate stand treatments. Natural and artificial reproduction. Silvicultural techniques. QF: FOR 204, CSS 210 QA: FOR 305

409. Forest Management
Fall. 4(3-0) P: FOR 420. Management of forests for timber production in a multiple-use context. Yield projections, harvest scheduling, management prescriptions, project analysis and administration. QF: FOR 305, FOR 455 QA: FOR 458