877**.** ***Fish Population Dynamics
Fall of even-numbered years. 3(3-0)
P: FW 479
Quantitative analysis of fish populations. Evaluation, causes and impact 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 even-numbered years. 5(3- 4)
P: Calculus, Computer Science
Chemical and environmental parameters which control the movement and disposition in aquatic environments. Use of fate models.
QA: FW 878

879**.** ***Advanced Limnology
Spring of odd-numbered years. 3(3- 0)

Physical, chemical and biological processes that affect productivity of aquatic ecosystems.
QP: FW 477 QA: FW 874 FW 875

891**.** ***Advanced Topics
Fall, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 10 credits.

In depth study of advanced topics in fisheries and wildlife
QA: FW 802

892**.** ***Seminar in Fisheries and Wildlife
Fall, Spring. 1(1-0) May reenroll for a maximum of 7 credits.

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. May reenroll for a maximum of 10 credits.
R: 6 19 25
Master's degree Plan B research paper

899**.** ***Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 24 credits.
R: 6 19 25

QA: FW 899

999**.** ***Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. May reenroll for a maximum of 48 credits.
P: Admission to doctoral program in Fisheries and Wildlife R: Doctoral level- 7 College of Agriculture and Natural Resources- 19 Fisheries and Wildlife- 25

QA: FW 999

FOOD ENGINEERING FE

329**.** ***Fundamentals of Food Engineering
Spring. 3(4-0) Interdepartmental with the Department(s) of Food Science.
P: MTH 124, PHY 231, FSC 211 R: Juniors and above
Unit operations in the food industry including: fluid mechanics, heat transfer, rate processes, refrigeration, freezing, and dehydration. Thermal process calculations.
QP: PHY 237 FSC 211MTH 109ORMTH 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: Juniors and above Engineering
Rheological behavior of fluid and semi-solid foods. Applications in mixing, pipeline design, extrusion, calendering, and coating.
QP: MTH 310 CHE 340ORCE 321OR QA: FE 475

433**.** ***Food Dehydration
Spring. 3(3-0)
P: CHE 321 or ME 410 R: Engineering majors
Dehydration of food and agricultural products, including bin, belt, rotary, spray, microwave, and solar drying of food products.
QP: AE 352 CHE 343 QA: FE 433

483**.** ***Food Process Engineering II
Fall. 3(3-0)
P: FE 381 or concurrent, MPH 205, CHE 321 or concurrent, CEM 362 or con R: Juniors and above Engineering
Kinetics of biological and food reactions, design and analysis of biological reactors, thermal processing, microbial death kinetics, sterilization and pasteurization, thermal process evaluation, aseptic processing.
QP: CHE 341 FE 475CEM 363MPH 200 QA: FE 477

485**.** ***Food Process Engineering III
Fall. 3(3-0)
P: FE 381, FE 483 or concurrently or ME 410 R: Juniors and above Engineering
Diffusion, mass transfer coefficients, separations, freezing, dehydration, process integration and design concepts.
QP: CHE 340 FE 475ME 411FE 477 QA: FE 373

487**.** ***Food Engineering Design Project
Spring. 4(2-4)
P: FE 483, FE 485 R: Seniors and above FE
Food engineering design and process integration. Process analysis and modification. Feasibility. Food industry regulations. Case histories from food, pharmaceutical and bioprocess industries.
QP: AE 486 FE 477 QA: FE 487

490**.** ***Directed Study
Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits.
P: FSC 211 or MMM 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 ORFSC 241 QA: FE 480

491**.** ***Special Topics in Food Engineering
Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits.
P: FSC 211 or MMM 221 or MTH 235. R: Open only to Engineering majors. Approval of department.
Special topics in food engineering.
QA: FE 490

FOOD SCIENCE FSC

211**.** ***Principles of Food Science
Fall. 3(3-0)
P: CEM 141 R: None None None None
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(3-3)
P: MTH 116, FSC 211 R: Sophomore and above
Fruit and vegetable composition and quality indices. Harvest and post harvest technology. Preservation systems: canning, freezing and specialized techniques.
QP: MTH 108 ANDMTH 109ORMTH 111
QA: FSC 460

331**.** ***Food Processing: Cereals
Fall. 2(3-3)
P: MTH 116, FSC 211 R: Sophomores and above
Classification and composition of cereals, milling processes, and cereal product manufacture.
QP: FSC 211 MTH 108ANDMTH 109OR QA: FSC 470

332**.** ***Food Processing: Dairy Foods
Spring. 2(2-6)
P: MTH 116, FSC 211 R: Sophomores and above
Fluid milk. Principles and technology involved in manufacturing dairy products. Marketing, distribution and regulations regarding dairy foods.
QP: MTH 108 ANDMTH 109ORMTH 111
QA: FSC 400 FSC 405

333**.** ***Food Processing: Meat, Poultry and Fishery Products
Spring. 2(2-6)
P: MTH 116, FSC 211 R: Sophomores and above
Meat animal, muscle foods and egg processing technology, product formulation and quality control. Manufacturing practices and principles of fresh, frozen and cured meats, sausages and processed products.
QP: MTH 108 ANDMTH 109ORMTH 111
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(0-3)
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.
QP: FSC 333 QA: FSC 333L

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 ORFSC 211ORHNF 411 QA: FSC 205

432**.** ***Advanced Food Processing: Dairy Foods
Fall of odd-numbered years. 3(2-3)
P: FSC 332 R: Juniors and above
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/Fish***
Fall of even-numbered years. 3(2-3)
P: FSC 333 R: Juniors and above
Scientific principles of processing animal tissues for food. Field trips required.
QP: FSC 345 QA: FSC 445

436*. ***Quality Assurance***
Fall. 2(2-0)
P: Two of the following: FSC 331, FSC 332, FSC 333, FSC 334; STT 201 R: Junior and above
Theory and application of quality assurance programs for food processing industries.
QP: STT 201 FSC 330 QA: FSC 457

440*. ***Food Microbiology***
Spring. 3(3-0) Interdepartmental with the Department(s) of Microbiology and Public Health.
P: MPH 205 R: Juniors or above
Major groups of microorganisms of importance to the food industry. Emphasis on ecological, physiological, and public health aspects.
QP: MPH 200 ORMPH 301 QA: FSC 440 OR MPH 440

441*. ***Food Microbiology Laboratory***
Spring. 1(0-3) Interdepartmental with the Department(s) of Microbiology and Public Health.
P: FSC 440 or concurrently, MPH 206 R: Juniors and above FSC; FTM; MPH; FE
Methods for studying major groups of microorganisms of importance to the food industry. Isolation, enumeration, characterization, identification and utilization 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 241FSC 333 QA: FSC 455 FSC 456

490*. ***Special Problems in Food Science***
Fall, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits.
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. 2(2-0)
P: FSC 401, 402, BCH 451 or approval of Department R: Level 6 or above None None None
An in-depth course on composition and structure of lipids, and their physical and chemical properties in relation to their function in foods.
QP: FSC 333 FSC 333LBCH 453 QA: FSC 952

840*. ***Advanced Food Microbiology***
Spring of odd-numbered years. 2(2-0)
P: FSC 440, or approval of Department R: Level 6 or above None None None
Recent advances in the microbiology of food production and processing including the detection, characterization, identification and enumeration of food associated pathogens; current/future applications and regulation of Food Biotechnology.
QP: FSC 440 ORAPPROVALOF DEPT. QA: FSC 832

850*. ***Analytical Techniques in Food Science***
Summer of odd-numbered years. 2(2-4)
R: Level 6 or above Agriculture and Natural Resources; Human Ecology Food Science or Human Nutrition
Laboratory and recitation experience focused on recent advances in analytical methodologies with applications to food systems.
QP: NONE QA: NONE

860*. ***Processing Research in Food Science***
Summer of odd-numbered years. 2(2-4)
R: Leve 6 or above None None None
Laboratory and recitation experience focused on recent advances in basic research and current process technology in applied food research.
QP: NONE QA: NONE

892*. ***Food Science Seminar***
Fall, Spring. 1(1-0) May reenroll for a maximum of 4 credits.
P: Approval of Department R: Level 6 and above
Oral presentation by students on current topics in Food Science.
QP: APPROVALOF DEPT. QA: FSC 990

899*. ***Master's Thesis Research***
Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 10 credits.
P: Approval of department R: M.S. students in Food Science
Individual research focused on the student's M.S. thesis.
QP: APPROVALOF DEPT. QA: FSC 899

901*. ***Food Proteins***
Fall of even-numbered years. 2(2-0)
P: BCH 461; FSC 401 or approval of Department R: Level 6 or above
Utilization and application of proteins and enzymes in the food industry. Functional properties of proteins and enzymes in food systems.
QP: BCH 452 FSC 333 QA: NONE

913*. ***Advanced Food Toxicology***
Fall of even-numbered years. 2(2-0) Interdepartmental with the Department(s) of Animal Science.
P: Departmental approval R: Level 6 and above
Concepts in toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, chemical carcinogenesis; risk assessment.

951*. ***Muscle Biochemistry***
Spring of odd-numbered years. 2(2-0)
P: BCH 452 R: Level 6 and above None None
Anatomical, physiological and biochemical properties of muscle. Structure and function of muscle proteins, regulation of muscle contraction, Biochemical changes post mortem, and meat protein functionality.
QP: BCH 453 QA: FSC 951

999*. ***Doctoral Dissertation Research***
Fall, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 30 credits.
P: Approval of Department R: Ph.D. students in Food Science
Individualized research focused on student's doctoral dissertation.
QP: APPROVALOF DEPT. QA: FSC 999

FOOD SYSTEMS ECONOMICS AND MANAGEMENT FSM

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 MTA 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 MTA 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 ORMGT 302

330. ***Farm Business Management***
Fall. 3(4-0)
P: FSM 200. 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 391. 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