

FOOD SCIENCE AND NUTRITION

Food Science and Nutrition
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For more information regarding faculty visit the Department of Food Science and Nutrition website.

The Department of Food Science and Nutrition (FDSN) consists of Illinois Institute of Technology faculty, in collaboration with U.S. Food and Drug Administration (FDA) scientists, and food industry experts, and provides a unique training ground for individuals seeking graduate education in food safety and technology and food process engineering.

The master's degree programs in food safety and technology (FST) and food process engineering (FPE) are designed to educate food technologists and engineers in aspects relating to food processing and safety. Students can specialize in food processing and packaging, food microbiology and safety, compositional safety of food (chemistry), and food for health (nutrition). Graduates of the program will be prepared to assume responsible positions in food manufacturing operations, research and development, food safety, compliance and regulatory affairs, and quality assurance in the processing, retail, and foodservice segments of the food industry. Other career options include positions with federal, state, or local health and agri-food agencies, and in policy-making, regulatory, or research roles with organizations associated with food manufacturing operations.

Facilities

FDSN makes use of the facilities of Illinois Tech's Moffett campus - home of the university's Institute for Food Safety and Health (IFSH.) These facilities include 40,000 square feet of research laboratories, office and meeting space, 26,000 square feet of industrial-scale pilot plant facility, 3,000 square feet of food processing plant (GMP), and 3,000 square feet of Biosafety Level-3 (BSL-3) Laboratory and Bio-containment Pilot Plant (BCPP). The research laboratory facilities at Moffett Campus include numerous laboratories for microbiology, virology, molecular biology, chemistry, biochemistry, nutrition, and engineering. A 5,000 square feet Clinical Nutrition Research Facility is also located at the university's Mies Campus. The pilot plant at IFSH houses state of the art equipment such as computer-controlled retorts, high temperature-short time plate pasteurizer, high-pressure food processors for pasteurization and sterilization studies, equipment for aseptic processing of particulate foods, pulsed electric field apparatus, ozone processor, UV food processors, homogenizers, and high power ultrasound. The BSL-3 and BCPP provide an opportunity to conduct studies on the control of pathogenic microorganisms using pilot-scale equipment. Further, microbiological, food engineering, chemical, and packaging laboratories support the pilot plant facilities. IFSH's food science and technology library provides both physical and systems access to current and retrospective research and technical publications. The 25,000 square feet of laboratories and facilities of the FDA Division of Food Processing Science and Technology physically located in the same building are also available to FDSN collaborative research projects.

Admission Requirements

All programs in the Department of Food Science and Nutrition require a bachelor's degree in chemistry; biology; food science; nutrition; chemical, agricultural, food, or environmental engineering; or a related field.

Minimum Cumulative Undergraduate GPA

3.0/4.0

Minimum GRE Scores

- Master of Science in Food Safety and Technology or Food Process Engineering: 304 (quantitative + verbal)
- Master of Food Safety and Technology or Food Processing Engineering: 295 (quantitative + verbal)

Students applying for the master's academic program (non-thesis option) with an undergraduate degree from a major U.S. university with a cumulative GPA of 3.0/4.0 or higher may not be required to submit a GRE score.

Minimum TOEFL Scores

80/550 (internet-based/paper-based test scores)

Note: Certificate programs do not require GRE and TOEFL scores.

Degrees Offered

- Master of Food Process Engineering
- Master of Food Safety and Technology
- Master of Food Safety and Technology with Specialization in Business
- Master of Food Safety and Technology with Specialization in Industrial Management
- Master of Science in Food Process Engineering
- Master of Science in Food Safety and Technology
- Master of Science in Nutrition Science
- Doctor of Philosophy in Food Science and Nutrition

Certificate Programs

- Food Process Engineering
- Food Processing Specialist
- Food Safety and Industrial Management
- Food Safety and Technology

Course Descriptions

FDSN 501

Advanced Nutritional Biochemistry

This course is designed to understand the biochemistry of energy and nutrient metabolism from consumption through digestion, absorption, distribution, assimilation and excretion, including cellular metabolism and regulation with a multisystem, integrative physiology approach. Acid-base and fluid balance, urea and biliary metabolism, inherited and acquired disorders, including the influence of environment and dietary factors will also be covered.

Prerequisite(s): FDSN 401 and (BIOL 401 or BIOL 402)

Lecture: 3 Lab: 0 Credits: 3

FDSN 502

Development, Delivery, and Dissemination

This course is an introduction to writing and presenting on scientific research with a focus on skills necessary for research at IIT's Institute for Food Safety and Health. Topics will include defining a problem, structuring a literature review, creating a research proposal, and written and oral presentation of research results.

Lecture: 3 Lab: 0 Credits: 3

FDSN 504

Food Biotechnology

Introduction of biotechnology in the food industry including genetic engineering of microorganisms. Fundamentals of microbial genomics and proteomics. Practice of a variety of software and bioinformatics tools including database search, sequence alignment, phylogenetic and cluster analyses, gene production, genomic map construction, and structural and functional prediction of proteins. Applications of DNA fingerprinting techniques in food safety and public health.

Lecture: 3 Lab: 0 Credits: 3

FDSN 505

Food Microbiology

Principles of occurrence and control. Importance of sanitation and prevention of public health problems. Microbiological contaminants and methods for their detection. Mechanisms of microbial inactivation.

Lecture: 3 Lab: 0 Credits: 3

FDSN 506

Food Microbiology Laboratory

Introductory Microbiology. Basic microbiological techniques and safe laboratory practices. Introductory Food Microbiology. Isolation pathogenic bacteria. Spoilage microorganisms. Fermentation. Environmental Monitoring. Rapid Identification tests. Sporeformers.

Lecture: 0 Lab: 3 Credits: 3

FDSN 507

Food Analysis

Techniques for analyzing food toxins, food constituents of public health concern, intentional and unintentional food additives, modern separation and analytic techniques.

Lecture: 3 Lab: 0 Credits: 3

FDSN 508

Food Product Development

Students in this class will learn how to do the following: identify the key steps in the food product development process and stage gate concepts; develop a formulation approach with ability to effectively understand how to work well with vendors, handle labeling regulations, food safety, and consumer acceptability requirements; create a product unit costing with trade-offs and contingencies for market launch; identify key performance requirements for product shelf life testing and packaging specifications; evaluate product quality and safety with traditional and state of the art assessment tools; how to conduct consumer tests, plant trials, and introduce new products and processes into the manufacturing operation and contingency planning; and develop a strategy to monitor and improve product performance.

Lecture: 3 Lab: 0 Credits: 3

FDSN 509

Fundamentals of Biostatistics and Epidemiology in Food Science and Nutrition

This course covers fundamental concepts in biostatistics and epidemiology with an emphasis on applications to food science, food safety, and nutrition. The course will emphasize study designs and epidemiologic and statistical methods used to investigate the relationships between health-related variables with particular attention to food-related exposures in health and disease.

Corequisite(s): FDSN 510

Lecture: 3 Lab: 0 Credits: 3

FDSN 510

Fundamentals of Biostatistics and Epidemiology Laboratory in Food Science and Nutrition

This laboratory course covers fundamental concepts in biostatistics and epidemiology with an emphasis on applications to food safety and nutrition. The course will emphasize study designs and epidemiologic and statistical methods used to investigate the relationships between health-related variables with particular attention to food-related exposures in health and disease. Self-directed course.

Corequisite(s): FDSN 509

Lecture: 0 Lab: 2 Credits: 1

FDSN 511

Food Law and Regulations

Legal and scientific issues in regulating the nation's food supply and nutritional status. Roles of regulatory agencies; Federal Food, Drug and Cosmetic Act; definitions and standards for food and adulterated foods. Manufacturing processed foods in compliance with regulations.

Lecture: 3 Lab: 0 Credits: 3

FDSN 514**Unit Operations in Food Processing**

This course will introduce the students to various food processing technologies used in the food industry. Students will learn about a wide range of unit operations such as mixing, separation, concentration, blanching, pasteurization, evaporation, extrusion, dehydration, baking, roasting, frying, chilling, controlled atmospheric storage, freeze drying, coating, enrobing, filling and sealing. The emphasis will be on implementation of unit operations in the food industry and the impact of these unit operations on food safety, nutrition and consumer acceptability.

Lecture: 3 Lab: 0 Credits: 3

FDSN 519**Food Process Engineering Lab**

This course provides hands on experience to students on various unit operations. Students will be exposed to heat and mass transfer in food processing, fluid flow, preservation processes, cooling, freezing, freeze drying, thermometry and alternative methods of food processing.

Lecture: 0 Lab: 3 Credits: 3

FDSN 520**Low-Acid Canned Food Regulations and Microbiology**

Regulatory requirements for the U. S. Food and Drug Administration and the broad microbial issues associated with low-acid canned foods (LACF) products. Topics will include the U. S. Food Drug & Cosmetic (FD&C) Act, Emergency Permit Control, 21 Code of Federal Register (CFR) parts 108, 113, and 114, record requirements, sources of microbial contamination, characteristics of clostridium botulinum, mesophilic sporeformers, indicator organisms, and introduction to microbial heat resistance.

Lecture: 3 Lab: 0 Credits: 3

FDSN 521**Food Process Engineering**

Food engineering fundamentals, heat transfer in food processing, food rheology, freezing of foods, food dehydration, kinetics of chemical reactions in foods, refrigeration and thermal process calculations, and alternative methods of food processing.

Lecture: 3 Lab: 0 Credits: 3

FDSN 522**Advanced Food Process Engineering**

Process calculations for food processing methods such as canning, aseptic processing, ohmic heating, microwave processing and pulsed energy processing. Extrusion techniques in food processing. Discussion of new food processing techniques and safety implications.

Lecture: 3 Lab: 0 Credits: 3

FDSN 523**Food Engineering Process Delivery**

Requirements for the U. S. Food and Drug Administration food canning regulations, including system design, process establishment, operational, and inspection records. Operations and calibration requirements of thermal processing equipment. Process design, documentation of process deviation, and calculation of process delivery.

Prerequisite(s): FDSN 522 with min. grade of C

Lecture: 3 Lab: 0 Credits: 3

FDSN 524**Fundamentals of Food Science**

This course will cover the central food science issues encountered with storage and processing of all major American food commodities including meats, grains, confections, vegetables, eggs, and dairy. It will also review the relevant chemistry, physics, and engineering required to understand common food-related unit operations such as drying, freezing, sterilization, and radiation treatment of foods. An introduction to microbial and chemical issues of food quality and safety will also be covered.

Lecture: 3 Lab: 0 Credits: 3

FDSN 526**Engineering Principles of Food**

Methods for conducting seal integrity examinations, spoilage diagnosis, and traceability, defining and classifying package defects. Types of packaging materials, including metal, glass, plastics, flexible and composite containers, and their closure and sealing systems. Aseptic and alternative process delivery systems.

Lecture: 3 Lab: 0 Credits: 3

FDSN 530**Practical Clinical Nutrition Research**

This course is designed to give students experience in human and clinical nutrition research. The course will include shadowing and hands-on opportunities of assessment and technologies used in qualifying health and disease risk status. Students will learn about different research models and the techniques to assess effects of dietary components on physiological processes. Students will work with anonymized data derived from clinical trials. Statistical approaches will be taught along with differences between statistical and biological relevance. Study design and ethics in human research will be covered. Regulatory standards in health claims and drug and biologics development governed by FDA will also be addressed. Physiology strongly advised. Human biology recommended.

Lecture: 0 Lab: 3 Credits: 2

FDSN 531**HACCP Planning and Implementation**

Examination of the Hazard Analysis and Critical Control Point (HACCP) principles; microbiological and process overviews; generic HACCP models, Good Manufacturing Practices (GMP); monitoring of critical control points (CCPs), process control and implementation.

Lecture: 3 Lab: 0 Credits: 3

FDSN 535**Performance Management in Food Operations**

Creating an organization-wide culture of quality and performance is critical to managing the unique demands of a food processing company. Learn how to develop, manage, and improve food production processes, implement lean principles to eliminate waste and improve yields, and measure operational performance. Topics covered include budgeting and financial tools, introducing new food products and processes, Total Quality Management (TQM), evaluation and management of supply chain activities, and strategy deployment techniques. This course includes a Project Team Assignment from the participating plant personnel with at least one - two visits to a Food Processing Plant in the Chicago Area. An introductory course in Food Processing or Food Safety is helpful. Experience in MS Excel Worksheets, MS Word, and MS Power Point is highly recommended. This course ideally follows the FSN 408 508 Food Product Development Course as it teaches the final phases of food product development of taking a product into a manufacturing operation and how to ensure optimum performance in production.

Lecture: 3 Lab: 0 Credits: 3

FDSN 541**Principles of Food Packaging**

Type and application of packaging materials. Migration theories and food package interaction, package testing to ensure safety, and recycling of package materials.

Lecture: 3 Lab: 0 Credits: 3

FDSN 591**Research and Thesis**

Research and Thesis for Master of Science Degree students.

Credit: Variable

FDSN 593**Seminars in Food Science and Nutrition**

Students attend seminars offered during the semester. Each student is also required to give a 30-minute presentation on a topic of his/her interest or a research project on which she/he has worked.

Lecture: 0 Lab: 1 Credits: 1

FDSN 594**Special Projects**

Advanced projects in food processing and packaging, food microbiology and safety, food chemistry, and nutrition.

Credit: Variable

FDSN 597**Special Problems**

Independent study of advanced topics in food science and nutrition including food processing and packaging, food microbiology and safety, food chemistry, and nutrition.

Credit: Variable

FDSN 600**Continuing of Residence**

Continuing of residence.

Lecture: 0 Lab: 1 Credits: 1

FDSN 610**Advanced Topics in Food Microbiology**

This course is an advanced course in food safety microbiology covering the latest development and trends in food safety related microbiology, including emerging foodborne pathogens of public health significance, as well as the use of the latest technologies for the detection and control of these microbial food safety hazards.

This course can be used as credits towards candidature for a Ph.D. degree in Food Safety and Technology/Food Science and Nutrition.

Lecture: 2 Lab: 0 Credits: 2

FDSN 620**Advanced Topics in Food Chemistry**

This course can be used as credits towards candidature for a Ph.D. degree in Food Science and Nutrition. This course is expected to cover advanced knowledge in the chemistry of the components of foods, their physiochemical properties and chemical interactions, and the chemical changes that occur during processing, storage, and packaging. Students are expected to work on evidence derived from original research literature, interpretation of research findings, and problem solving based on the scientific principles of food chemistry. This advanced program is open to individuals who hold undergraduate degrees in chemistry, food science, or related disciplines. Students who have completed the FDSN 524 Fundamentals of Food Science and Technology and FDSN 507 Food Analysis courses with a B or higher may also apply. Upon successful completion of this course, students are expected to be able to translate theory and research into practice.

Lecture: 2 Lab: 0 Credits: 2

FDSN 630**Advanced Topics in Nutrition**

This course can be used as credits towards candidature for a Ph.D. degree in Food Science and Nutrition. This course is expected to cover advanced knowledge in nutrition, metabolism, disease prevention and health promotion. This advanced program is open to individuals who hold undergraduate degrees in nutritional science, food science, health science, biology, biochemistry, chemistry or related disciplines. Students who have completed the FDSN 501 course with a B or higher may also apply. Upon successful completion of this course, students are expected to be able to translate theory and research into practice.

Lecture: 2 Lab: 0 Credits: 2

FDSN 640**Advanced Topics in Food Process Engineering**

This course covers recent advancements and developments in food engineering and food processing including novel and emerging processing technologies, advanced thermal process calculations, modeling, simulation, sustainable food processing, process controls & automation and kinetics of food transformations, energy reduction, and food rheology. This course can be used towards candidature for a Ph.D. degree in Food Safety and Technology/Food Science and Nutrition.

Lecture: 2 Lab: 0 Credits: 2

FDSN 691**Research and Thesis**

Research and Thesis for Ph.D. Food Science Candidates.

Credit: Variable

FDSN 695

Food Science and Nutrition Research Seminar

This course is designed for Ph.D. students to attend research seminars that are presented by invited speakers from academia, food industry and federal government agencies to broaden their understandings and knowledge of various scientific topics and original research in Food Science and Nutrition. This course is mandatory for all Ph.D. students enrolled in the FDSN program. A minimum of 2 credits or 2 semesters of attendance is required for each student. It does not deal with specific techniques per se, but rather with the assumptions and the logic underlying food science and nutrition research. Students will become acquainted with a variety of approaches to research design from the speakers which, in turn, will help to develop their own research projects. A written report that summarizes the major impacts and findings of all presentations is due at the end of the semester.

Lecture: 1 Lab: 0 Credits: 1