The Department of Food Science and Nutrition (FdSN) at IIT offers graduate programs in Food Safety and Technology (FST) and Food Process Engineering (FPE) 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 food service 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.

### Degrees Offered

- **Master of Science in Food Safety and Technology** (Thesis Option)
- **Master of Food Safety and Technology** (Non-Thesis Option)
- **Master of Food Safety with Specialization in Business** (Non-Thesis Option)
- **Master of Science in Food Process Engineering** (Thesis Option)
- **Master of Food Process Engineering** (Non-Thesis Option)

- **Master of Food Safety and Technology with Specialization in Industrial Management** (Non-Thesis Option)

### Certificate Programs

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

### Facilities

The IFSH 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 Biosafety Level-3 Laboratory 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 IIT Main 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 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.
Faculty

Brackett, Robert E., Professor of Food Science, Vice President, Director of the Institute for Food Safety and Health (IFSH), and Interim Chair of Food Science and Nutrition. B.S., M.S., Ph.D. University of Wisconsin-Madison. Microbiological food safety; growth and survival of psychrotrophic pathogens in foods; physical/chemical controls for pathogens in foods; and microbial ecology of plant products.

Burton-Freeman, Britt, Associate Professor of Food Science and Nutrition and Director of the Center for Nutrition Research at the Institute for Food Safety and Health. B.S. California State University; M.S., Ph.D. University of California-Davis. Appetite and obesity management and vascular disease. Research emphasizes on the effect of bioactive food components on mechanistic and behavioral processes of food intake and body weight regulation. Properties of fibers, micro- and macro-molecule interactions, and food matrix effects in the gut to alter metabolic and endocrine system. Effects of dietary constituents on vascular diseases including evaluation of endothelium function, platelet activation, inflammatory and oxidative stress responses during acute and chronic interventions. The research approach includes human and basic science methodologies.

Cappozzo, Jack, Adjunct Industry Professor of Food Science and Nutrition, Director of Chemistry at the Institute for Food Safety and Health. M.S., Illinois Institute of Technology. Analytical chemistry with emphasis on separation science using high performance liquid chromatography (HPLC) coupled to mass spectrometry (MS). Interest has been on new methods of analysis using high resolution HPLC-MS to detect ultra-low levels of vitamins, anthocyanins, and other phenolic antioxidants in foods and clinical samples to support clinical trials. In addition, core work is also performed in the areas of allergen cleaning and analytical methods.

Diel, Todd, Adjunct Industry Professor of Food Science and Nutrition, Project Coordinator, Institute for Food Safety and Health. B.S. University of Illinois, M.B.A. Michigan State University. Organizational administration; project management; research project planning, coordination and risk assessment; occupational health and environmental safety, specializing in laboratory safety and training; quality assurance management.

Edirisinghe, Indika, Assistant Professor of Food Science and Nutrition and Manager, Center for Nutrition Research at the Institute for Food Safety and Health. B.Sc., University of Delhi (India); M.Phil., Ph.D., University of Peradeniya(Sri Lanka). Effect of polyphenolic compounds on endothelial function, blood pressure regulation, platelet function, insulin resistance, inflammatory and oxidative stress responses during acute and chronic interventions. The research approach includes human cell culture, animal models and human clinical trials.

Grasso, Elizabeth M., Research Assistant Professor of Food Science and Nutrition, Research Scientist at the Institute for Food Safety and Health. B.S. Pennsylvania State University; M.S., Ph.D. The Ohio State University. Microbial food safety; microbial cross-contamination; processing conditions and their effect on pathogen inactivation; sanitation of food-contact surfaces; survival and thermal inactivation of pathogens in low water activity foods; and effects of inoculation on microbial survival and inactivation in food matrices.

Grove, Stephen, Assistant Professor of Food Science and Manager of Industry Projects at the Institute for Food Safety and Health (IFSH). B.App.Sci., B.App.Sci.(Hons.), RMIT University (Australia); Ph.D., University of Tasmania (Australia). Microbial food safety; fresh produce and sprout safety; cross-contamination, inactivation and detection of enteric viruses during food processing and handling; use of novel processing and sanitation techniques for fresh-cut produce; and survival and inactivation of bacterial pathogens in low moisture foods.

Krishnamurthy, Kathiravan, Assistant Professor of Food Science and Nutrition and Research Engineer at the Institute for Food Safety and Health. B.E. (Ag), Tamil Nadu Agriculture University (India), M.S., Ph.D., Pennsylvania State University. Food engineering, novel and emerging food processing technologies, simulation and modeling of food processes, food safety, thermal processing technologies.

Lee, Alvin, Associate Professor of Food Science and Nutrition and Director of the Center for Processing Innovation at the Institute for Food Safety and Health (IFSH). B. App.Sci. (Hons), Ph.D., RMIT University (Australia). Microbial food safety, food virology, molecular detection and quantification of enteric pathogens; molecular characterization of virulence mechanisms, cell culture, intervention strategies for foodborne pathogens.

Paradis, Armand, Adjunct Industry Professor of Food Science and Nutrition and Director of Business Development at the Institute for Food Safety and Health (IFSH). B. S. in Biology, Northwestern University; M.S. Food Science and Nutrition, M.S. Food Engineering, University of Massachusetts. Product and process development, stage gate processes, novel technology assessment, industrial gas applications for food product microbial safety and stability, including carbon dioxide, nitrogen, and ozone, modified atmosphere packaging, hazard analysis of critical control points, lipid oxidation, and edible oil quality analysis.

Sui, Qian, Research Assistant Professor of Food Science and Nutrition and Special Projects Leader. B.E., China Agricultural University; Ph.D., The University of Melbourne (Australia).
Tompkin, Bruce, Adjunct Industry Professor at the Institute for Food Safety and Health and Retired, Vice President-Product Safety, ConAgra Refrigerated Foods, Inc. Currently a Food Safety Advisor. B.S., Ohio University; M.S., Ph.D., The Ohio State University. Microbial food safety and quality, food safety management.

Wan, Jason, Professor and Associate Chair of Food Science and Nutrition and Associate Director at the Institute for Food Safety and Health (IFSH). B.S., Hunan Agricultural University (China); M.S., Northeast Agricultural University (China); Ph.D., Deakin University (Australia). Molecular microbiology including development of DNA-based methods for detection, differentiation and tracking of foodborne pathogens in food systems and environment. Emerging non-thermal processing technologies, including high pressure processing (HPP), pulsed electric field (PEF), ultrasound, UV and non-thermal plasma, for microbial inactivation, shelf-life extension and food safety enhancement. Dairy processing, protein chemistry, and development and evaluation of bioactive dairy ingredients for functional food applications.

Wasan, Darsh T., Distinguished Motorola Professor of Chemical Engineering and Vice President for International Affairs. B.S., University of Illinois, Urbana-Champaign; Ph.D., University of California-Berkeley. Thin liquid films, foams, emulsions and nanoparticle suspensions, film rheology and applications, wetting, spreading and adhesion of nano-fluids on solid surfaces, environmental technologies, food colloids.

Zhang, Wei, Associate Professor of Food Science and Nutrition and Principal Scientist at the Institute for Food Safety and Health (IFSH). B.S., M.S., Huazhong Agricultural University (China); Ph.D., Pennsylvania State University. Molecular detection, genotyping, epidemiology, virulence and pathogenesis of foodborne bacteria; microbiology, biotechnology.
Admission Requirements

Bachelor’s degree in chemistry, biology, food science, nutrition, or chemical, agricultural, food or environmental engineering, or a related field.

Cumulative undergraduate GPA minimum: 3.0/4.0

1. GRE of 304 (verbal and quantitative) for Master of Science, Food Safety and Technology or Food Process Engineering (Thesis)

2. GRE of 295 for 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, and Master of Food Processing Engineering (Non-Thesis)

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.

3. TOEFL minimum: 550/213/80 (paper based/computer-based test score)

Note: Certificate Programs do not require GRE and TOEFL scores.
Master of Science in Food Safety and Technology

32 credit hours
Thesis required

Candidates are required to take a total of 32 credit hours, 18 of which must be selected from the core food safety and technology courses listed below, 6-8 credit hours must be in research and thesis work and 6-8 credit hours from electives. Courses are offered at the IIT Main Campus or via internet with the exception of FST 506.

Core Course Requirements (18 credit hours)
FST 505 Food Microbiology
FST 506 Food Microbiology Laboratory
FST 507 Food Analysis
FST 521 Food Process Engineering
FST 524 Fundamentals of Food Science and Technology
FST 541 Principles of Food Packaging

Core Research Thesis Requirement (6-8 credit hours)
FST 591 Research and Thesis for M.S. Degree

Research for the thesis must be carried out under the direct supervision of a participating faculty member. Based on the requirements of the research project, thesis committee members may be chosen from IIT faculty members from various departments, FdSN/FDA scientists, and the food industry scientists. The final thesis examination consists of submission of a written thesis followed by an oral presentation open to all FdSN/IFSH staff and the university community. As a part of the thesis, the student is expected to contribute scholarly article(s) to one or more high quality peer-reviewed journals. The student is also encouraged to present the research at a national professional society meeting.

Electives (6-8 credit hours)
FST 501 Nutrition, Metabolism, and Health
FST 502 Research Project: Design, Delivery, and Dissemination
FST 504 Food Biotechnology
FST 511 Food Law Regulations
FST 531 HACCP Planning and Implementation
FST 593 Seminar on Food Safety and Technology
FST 594 Special Projects
FST 597 Special Problems (dependent upon number of thesis credits taken, please consult FdSN Academic Advisor)

Students may enroll in FST 594 and FST 597 up to a maximum of 2 credit hours between both courses when enrolled in 6 credits of thesis; or 1 credit hour when enrolled in 7 credit hour of thesis. However, if the 597 is used as a short course, the student can register up to 4 credits in 597 with FdSN advisor approval. Students may not enroll in FST 594 or 597 when using 8 credits of thesis unless 597 is used as a short course.

Students must have a minimum grade point average of 3.0/4.0. In addition to the core courses required and electives, further courses may be selected from other departments with the approval of the FdSN advisor, to fit the background and needs of the individual student.
Master of Food Safety and Technology

32 credit hours
No thesis required

Candidates are required to take a total of 32 credit hours, 18 credit hours of which must be selected from the core food safety and technology courses listed below, and 14-17 credit hours must be selected from electives. Courses are offered at the IIT Main Campus or via internet with the exception of FST 506.

Core Courses (18 credit hours)
FST 505 Food Microbiology
FST 506 Food Microbiology Laboratory
(Required unless the student has enough professional background or laboratory experience to substitute, decision will be made by the FdSN Graduate Program Director)
FST 507 Food Analysis
FST 521 Food Process Engineering
FST 524 Fundamentals of Food Science and Technology
FST 541 Principles of Food Packaging

Electives (14-17 credit hours)
FST 501 Nutrition Metabolism and Health
FST 502 Research Project: Design, Delivery and Dissemination
FST 504 Food Biotechnology
FST 511 Food Law Regulations
FST 522 Advanced Food Process Engineering
FST 531 HACCP Planning and Implementation
FST 593 Seminar on Food Safety and Technology
FST 594 Special Projects
FST 597 Special Problems

Students can enroll in FST 594 and 597 with a maximum of 6 credit hours total between both courses with an FdSN advisor approval. However, when 597 is used as a short course, the total credit hours must not exceed 8 between 594 and 597 combined. The student must have a minimum grade point average of 3.0/4.0. In addition to the core courses required and electives, further courses may be selected from other departments with the approval of the FdSN advisor, to fit the background and needs of the individual student.

Master of Food Safety and Technology with Specialization in Business

32 credit hours

This program is designed to help Food Safety and Technology degree students extend their food science technical and practical knowledge of the field while introducing them to core topics in modern business practices to prepare them for careers in the industry. To complete the program, students must satisfy the Master of Food Safety and Technology requirements and Stuart School of Business specialization, totaling 32 credit hours. Courses are offered at the IIT Main Campus or via internet with the exception of FST 506.

Specialization Core Course Requirement: (3 credit hours)
BUS 510 Building an Innovative and Sustainable Business

Specialization Electives: (6 credit hours)
Choose two from the following
MBA 501 Accounting for Strategic Decision Making
MBA 509 Financial Management on a Globalized World
MBA 511 Creating, Communicating, & Delivering Customer Value
MBA 513 Operations & Technology Management

Note: Stuart School of Business tuition and fees apply to these courses. Applicants to the program are not required to take the GMAT.

Master of Food Safety and Technology with Specialization in Industrial Management

32 credit hours

This program is designed to help Food Safety and Technology degree students extend their food science technical and practical knowledge of the field while introducing them to core topics and providing up-to-date knowledge of the technologies and modern management approaches used in world-class industrial companies. To complete the program, students must satisfy the Master of Food Safety and Technology requirements and Industrial Technology and Management specialization requirements, totaling 32 credit hours.

Specialization Electives: (9 credit hours)
Choose three from the following
INTM 508 Cost Management
INTM 511 Industrial Leadership
INTM 515 Advanced Project Management
INTM 518 Industrial Risk Management
INTM 520 Applied Strategies for the Competitive Enterprise
Master of Science in Food Process Engineering

32 credits hours
Thesis and oral defense required

Candidates are required to take a total of 32 credit hours, 18 of which are the required courses listed below, 6-8 credit hours in Research and Thesis, 5-6 credit hours must be taken from Chemical and Biological Engineering Department courses, and the remaining 1-3 credit hours can be taken from FPE electives, if needed.

Core Courses Requirements (18 credit hours)
FPE 505 Food Microbiology
FPE 506 Food Microbiology Laboratory
FPE 521 Food Process Engineering
FPE 522 Advanced Food Process Engineering
FPE 524 Fundamentals of Food Science and Technology
FPE 541 Principles of Food Packaging

Core Research Thesis Requirements (6-8 credits)
FST 591 Research and Thesis

Research for the thesis must be carried out under the direct supervision of a participating faculty member. Based on the requirements of the research project, thesis committee members may be chosen from IIT faculty members from various departments, FdSN/FDA scientists, and the food industry scientists. The final thesis examination consists of submission of a written thesis, followed by an oral presentation open to all IFSH staff and the university community. A thesis may be completed outside the department only by special arrangement with the department chair. The final examination is normally oral, but may be written at the discretion of the thesis examining committee.

As a part of the thesis, the student is expected to contribute to one or more high quality peer-reviewed journal article(s). The student is also encouraged to present the research at a national professional society meeting.

Elective Requirements (5-6 credit hours)
Students must take two courses from the following group of chemical and biological engineering courses:
CHE 426 Statistical Tools for Engineers
CHE 439 Numerical and Data Analysis
CHE 494 Process Design I
CHE 560 Statistical Quality and Process Control
CHE 577 Bioprocess Engineering
ENVE 513 Biotechnological Processes in Environmental Engineering
ENVE 542 Physicochemical Processes in Environmental Engineering

FPE Electives (1-3 credit hours)
FPE 501 Nutrition, Metabolism and Health
FPE 502 Research Project: Design, Delivery and Dissemination
FPE 504 Food Biotechnology
FPE 507 Food Analysis
FPE 511 Food Law Regulations
FPE 520 Low-Acid Canned Food Regulations and Microbiology*
FPE 523 Food Engineering Process Delivery*
FPE 526 Engineering Principles of Food*
FST 531 HACCP Planning and Implementation
FST 593 Seminar on Food Safety and Technology
FST 594 Special Projects
FST 597 Special Problems

Students may enroll in a ChBE course that is not listed above, with FdSN Advisor approval.

*Courses are designed specifically for the Food Processing Specialist Certificate Program
Master of Food Process Engineering

32 credits hours
No thesis required

Candidates are required to take a total of 32 credit hours, 18 of which must be from the core courses listed below, 8-11 credit hours must be selected from elective courses, and 5-6 credit hours must be selected from the Chemical and Biological Engineering Department Courses. Courses are offered at the IIT Main Campus or via internet with the exception of FPE 506.

Core Course Requirements (18 credit hours)
FST 505  Food Microbiology
FST 506  Food Microbiology Laboratory*
FST 521  Food Process Engineering
FST 522  Advanced Food Process Engineering
FST 524  Fundamentals of Food Science and Technology
FST 541  Principles of Food Packaging

*FPE 506 is required unless the student has enough professional experience to allow a substitute class, the decision will be made by the FdSN Program Director.

Electives (8-11 credit hours)
At least two of the following:
FST 501  Nutrition Metabolism and Health
FST 502  Research Project: Design, Delivery and Dissemination
FST 504  Food Biotechnology
FST 507  Food Analysis
FST 511  Food Law Regulations
FST 531  HACCP Planning and Implementation
FST 593  Seminar on Food Safety and Technology
FST 594  Special Projects
FST 597  Special Problems

Students can enroll in FPE 594 and 597 with a maximum of 6 credit hours total between both courses with FdSN Advisor approval. However, when 597 used as a short course, the total credit hours must not exceed 8 between 594 and 597.

At least two of the following: (5-6 credit hours)
CHE 426  Statistical Tools for Engineers
CHE 439  Numerical and Data Analysis
CHE 494  Process Design I
CHE 560  Statistical Quality and Process Control
CHE 577  Bioprocess Engineering
ENVE 513  Biotechnological Processes in Environmental Engineering
ENVE 542  Physiochemical Processes in Environmental Engineering

Students may enroll in a ChBE course that is not listed above, with FdSN Advisor approval.
Food Safety and Technology Certificate Programs

Food Safety and Technology (FST)

12 credit hours

The certificate program provides students with post baccalaureate knowledge of food safety and technology and its applications in the food industry, and in federal and state public health agencies. This program requires 12 credit hours for completion. Students who are admitted to FdSN master’s degree programs may apply coursework previously taken in a FdSN certificate program towards the requirements for the master’s degree with 3.0/4.0 GPA. Courses are offered at the IIT Main Campus or via internet with the exception of FST 506.

Four from the following:

- FST 501 Nutrition Metabolism and Health
- FST 504 Food Biotechnology
- FST 505 Food Microbiology
- FST 506 Food Microbiology Laboratory
- FST 507 Food Analysis
- FST 521 Food Process Engineering
- FST 524 Fundamentals of Food Science and Technology
- FST 531 HACCP Planning and Implementation
- FST 541 Principles of Food Packaging

Food Process Engineering Certificate Programs

Food Process Engineering (FPE)

12 credit hours

This program provides an introduction to the field of food engineering, with applications of chemical engineering principles to food manufacturing and food safety. Students must complete four courses (12 credit hours) for completion. Students who are admitted to FdSN master’s degree programs may apply coursework previously taken in a FdSN certificate program towards the requirements for the master’s degree with 3.0/4.0 GPA. Courses are offered at the IIT Main Campus or via internet with the exception of FPE 506.

Required Courses

- FPE 521 Food Process Engineering
- FPE 522 Advanced Food Process Engineering

And two of the following:

- FPE 504 Food Biotechnology
- FPE 505 Food Microbiology
- FPE 506 Food Microbiological Laboratory
- FPE 507 Food Analysis
- FPE 511 Food Law Regulations
- FPE 524 Fundamentals of Food Science and Technology
- FPE 531 HACCP Planning and Implementation
- FPE 541 Principles of Food Packaging

Food Processing Specialist

12 credit hours

This program provides a broad working knowledge of technical elements of thermal processing systems (with understanding of alternative technologies) to qualify at an intermediate level as a recognized Food Processing Specialist. Students must complete four courses (12 credits). Students who are admitted to FdSN FPE master’s degree program may apply coursework previously taken in this certificate program towards the requirements for the FPE master’s degree with 3.0/4.0 GPA. Courses are offered at the IIT Main Campus or via internet with the exception of FPE 506.

Required Courses

- FPE 520 Low-Acid Canned Food Regulations and Microbiology
- FPE 522 Advanced Food Process Engineering
- FPE 523 Food Engineering Process Delivery
- FPE 526 Engineering Principles of Food
Department of Food Science and Nutrition Courses

FST/FPE 501 Nutrition, Metabolism, & Health
Study of structures, types, and metabolism of carbohydrates, lipids, and proteins. Discussion of the biological roles of vitamins and minerals. Application and integration of metabolic knowledge with health promotion and chronic disease. (3-0-3)

FST/FPE 502 Food Microbiology
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. Prerequisite: Biology or Microbiology. (3-0-3)

FST/FPE 504 Food Biotechnology
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. Core course. Prerequisite: Introductory Microbiology or Food Science. (3-0-3)

FST/FPE 505 Food Microbiology Lab
Introductory Microbiology. Basic microbiological techniques and safe laboratory practices. Introductory Food Microbiology. Isolation pathogenic bacteria. Spoilage microorganisms. Fermentation. Environmental Monitoring. Rapid Identification tests. Sporeformers. Prerequisite: Microbiology or Food Science. (0-3-3)

FST/FPE 506 Food Microbiology
Techniques for analyzing food toxins, food constituents of public health concern, intentional and unintentional food additives, modern separation and analytic techniques. (2-0-3)

FST/FPE 507 Food Law 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. (3-0-3)

FST/FPE 508 Food Analysis
Food Safety and Public Health
Study of structures, types, and metabolism of carbohydrates, lipids, and proteins. Discussion of the biological roles of vitamins and minerals. Application and integration of metabolic knowledge with health promotion and chronic disease. (3-0-3)

FST/FPE 510 Food Engineering Process Delivery
Fundamentals in Food Science & Technology
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. (3-0-3)

FPE 523 Food Engineering Process Delivery
Food Engineering Process Delivery
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. (3-0-3)

FST/FPE 522 Advanced Food Process Engineering
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. Instructor permission is required. Prerequisite(s): [(FPE 520) OR (FPE 521) OR (FST 521)] (3-0-3)

FST/FPE 524 Fundamentals in Food Science & Technology
Fundamentals in Food Science & Technology
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. (3-0-3)

FPE 526 Engineering Principles of Food
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. Instructor permission is required. Prerequisite(s): [(FPE 523)] (3-0-3)
FST/FPE 531  
**HACCP Planning & 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.  
(3-0-3)

FST/FPE 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.  
(3-0-3)

FST/FPE 591  
**Research & Thesis**  
Research and thesis for master of science students. Minimum 6 credits required.  
(Credit: Variable)

FST/FPE 593  
**Seminar on Food Safety & Technology**  
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.  
(Credit: 1 Hour)  
(1-0-1)

FST/FPE 594  
**Special Projects**  
Advanced projects involving analysis of food safety processing, packaging and biotechnology systems.  
(Credit: 1-6 hours).  
(Credit: Variable)

FST/FPE 597  
**Special Problems**  
Independent study focusing on current problems, issues of professional relevance. Topics selected from food process engineering, food safety, packaging, biotechnology. Repeatable to a maximum of four credit hours.  
(Credit: 1-6 )  
(Credit: Variable)

FST/FPE 600  
**Continuing of Residence**  
Continuing of residence.  
(1-0-1)

FST/FPE 772  
**Design & Development of Food Products**  
(3-0-3)