

NEW UNDERGRADUATE PROGRAM

PROPOSAL

ILLINOIS INSTITUTE OF TECHNOLOGY

The following information is required by the Undergraduate Studies Committee to approve new programs. After approval by UGSC this form should be routed to Faculty Council for approval and then the Provost's office.

College(s): School of Applied Technology, SAT

Department(s): Food Science and Nutrition, FDSN

Date: 1/20/2020

Approvals Required

1. **Academic Unit Head(s):** Chair, FDSN
2. **Dean(s):** Dean, SAT
3. **Other:** Undergraduate Studies Committee, University Faculty Council, Provost, President, BOT

GENERAL INFORMATION

Program Title: Bachelor of Science in Food Science and Nutrition

Program Scheduling: Fall 2020

Total Program Credit Hours: 128-129

Program Description: *Provide a brief narrative of the program content (use as much space as needed).*

Bachelor of Science in Food Science and Nutrition (FDSN) is a degree program that prepares students for a career that involves the application of science, technology, engineering and regulatory to address modern day food and health related problems. This unique program provides foundational training in food science and nutrition with contemporary practical training in topics pertinent to the food, manufacturing, pharma/biotech, and agricultural industries, including operations management, computation and data analytics, regulatory, and design thinking.

The sciences of Food and Nutrition are inherently multi-disciplinary making it an ideal program for Illinois Tech. It's a field that integrates studies of chemical, biological, physical sciences with other

processes that influence food's/ingredient's quality, safety, nutritional and health-promoting value to humans, and can utilize state of the art technology and computational advancements to enable other food-related practices and activities such as product design, packaging, culinary and new product development, optimization of food manufacturing processes and more.

FDSN students must have a keen understanding of human factors, ethical issues, law, and be equipped with excellent communication and critical thinking skills to engage in varied professional settings, in addition to having the detailed knowledge of the field. The FDSN program is a “learn by doing” program leveraging experience in our distinctive human and biosciences research labs, cognitive function and consumer understanding lab, pilot plants, including a Good Manufacturing Practices (GMP) plant area at the Moffett campus, and envisioned food innovation and technology kitchen and properties lab (FIT kitch/lab coming soon). Students will have practical experience applying classroom theory to local and global issues, be able to trouble-shoot and develop strategies/methodologies to advance industry, science and policy standards.

With over 4500 food and ingredient companies operating within a short commuting radius of Illinois Tech, the Chicagoland region offers an immense and immersive field laboratory and can serve as the career-launching platform for Illinois Tech FDSN students. The undergraduate program will be a major link between our food industry partners and career path seekers whether securing their first job, updating skills, and or switching or advancing their careers. Recent statistics (May 2018) indicate Chicagoland is the leading region in the USA for employment for Food Science majors, with the highest annual mean salaries (see the Program Viability section for more information).

Program Purpose/ Program Benefits: *Provide details on the intent of the program and its relation to other programs. State the impact of the program for students and for IIT.*

All major industries such as food, health care, defense, space, energy, government, transportation, are impacted by food, nutrition and health challenges. There is great need for an educated workforce who can lead the transition in feeding more people health-promoting, safe food that is affordable with low environmental impact. This challenge goes beyond state lines and country borders. Most universities that offer an undergraduate program in Food Science and Nutrition do so from a historical perspective and service to their state as a land grant university. In this legacy, many of the traditional programs are dictated by the state's specialized needs, whereas Illinois Tech's program has unencumbered white space to boldly address local, national and world challenges centered on safe, sustainable diets that will require a reorganization of food systems and transformation of production and consumption patterns.

Our program is a unique offering designed with input from food and related industries that develops graduates who understand how the food industry functions currently, and who will be capable of propelling that industry to where it needs to be in the future. This graduate is prepared to step into a multitude of roles, from digitally-enabled food production, including the application of new and emerging food processing technologies, food safety and regulatory compliance, to applying novel techniques and ingredients in food product development and formulation testing, to design and business management, all while addressing global food economies and health issues. The program has an additional advantage of being the only degree of its kind offered within the City of Chicago.

Benefits

- 1) Provide an unprecedented interaction between university students and the Chicagoland food industry. Companies will have access to a dynamic candidate pool that they will have the opportunity to shape directly through interactive classrooms, hand-ons/project-based labs, and IPRO experiences.

- 2) Draw on the expertise and prestige of Illinois Tech's other departments, including computer science, design, engineering, architecture, business, law, psychology to create a truly distinctive and transformative experience that transcends traditional boundaries fueling discovery, creativity and solving important problems.
- 3) Grow the student body. A new and unique FDSN undergraduate program will add students to the existing undergraduate population attracting domestic and international students, of all ages.
- 4) An undergraduate program in FDSN will augment degree offerings in other disciplines through individual class experiences, minor degrees and certificates we offer giving students additional career tracks to pursue not previously planned.
- 4) Foster collaborative and integrative culture at Illinois Tech. Food and health touch every life on this campus whether casually or professionally. Social-cultural courses and events organized around food customs, traditional flavors, and functional ingredients can provide a completely new and engaging experience for students, staff and faculty bringing the Illinois Tech community closer together. Local and global issues of safely nourishing and hydrating 10 Billion in urban and rural centers without starving the planet is a topic every discipline at Illinois Tech could tackle.
- 5) Leverage Illinois Tech's unique relationship with the FDA and the food industry via the Institute for Food Safety and Health to give our graduates an educational experience that cannot be had anywhere else in the world.

PROGRAM JUSTIFICATION

Why Illinois Tech? 1. Unmet food industry needs that Illinois Tech can deliver on, 2. Chicago is a food mecca, 3. Illinois Tech has foundational expertise in FDSN, 4. FDSN faculty and staff have strong relationships with the food industry, professional organizations, and government 5. Job opportunities for students available in the food and health sector out-number well-trained students to fill them.

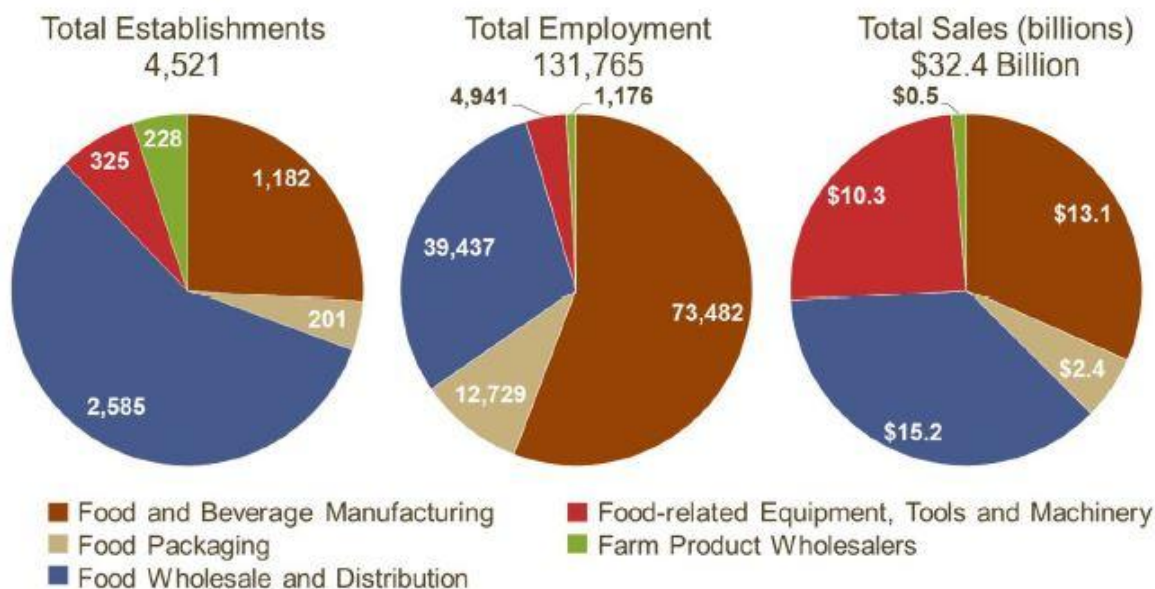
In recent years, such pressures as operational flexibility, advanced automation, modernization, regulations, quality control and management, environmental issues, affordable food, innovation to meet the demands of a new generation have motivated the food processing industry to search for an interdisciplinary and technical workforce. Moreover, as new and more complex technologies are adopted and regulatory hurdles elevated, technical professionals with management skills and regulatory know-how are required. However, the traditional form of a food science and nutrition education is to provide employees to such industries that are stand-alone, that is, deeply equipped in a single area. Industry tells us they need well-rounded students with broad hands-on experiences that make them "ready-to-work", so that additional in-house, on-the-job training after the hiring would be minimal. Industry is also telling us that understanding and applying digital tools to plant operations, food formulation, flavor, recipe scaling, content creation and delivery, understanding consumer behavior in food choice, mapping and predicting safety risks in plants, are all top skills they look for when building a workforce. Government leaders describe needs for students to have in depth knowledge in respective science and engineering disciplines with application to the fields of food science and nutrition, and training in the latest technologies as they are applied in the food industry paired with critical thinking skills against a backdrop of food law and regulations. With this background, we are proposing an unparalleled undergraduate program that meets the needs of the food industry but provides the skills and training that can/will be cross applied and competitive for jobs in biotech, healthcare, government and more.

(Above source: Mahalik, Nitaigour & Choudhury, Gour & Yen, Matthew. (2008). Food Plant Operation and Management (FPOM): A Proposed New Program Option. American Society of Agricultural and Biological Engineers - Food Processing Automation Conference 2008. 10.13031/2013.24561 and interviews with large and small companies, including start up incubators, professional organizations (IFT), and its members, FDA leaders, alumni).

The unique relationship of the FDSN department with the FDA, IFSH, the Institute for Translation Medicine (ITM) at University (U) of Chicago, and the Chicagoland food industry offers opportunities for Illinois Tech students not available at other Universities. The next closest University with programs in food science are U of Illinois, Champaign, IL and U Wisconsin, Madison WI. None of these schools are located sufficiently close to Chicago to be as uniquely engaged with what is now emerging as the Silicon Valley of the Food Industry. In addition, major food and health professional organizations have their headquarters here in Chicago: Institute of Food Technologists (IFT), the Research Chefs Association (RCA), Academy of Nutrition and Dietetics (AND), American Medical Association (AMA). The IFT is the organization, which has direct links to the food industry talent pipeline via its 20,000-plus professional members. The IFT commands the academic guidelines for food science four year programs. In a corresponding fashion, the RCA commands the guidelines for a rapidly emerging and industry desired academic field known as Culinology. As one might expect from the RCA's own trademarked term "Culinology" it is the blending of food science with the culinary arts. With the growing consumer driven trend of new food product innovation coming from the culinary executive chef and entrepreneur food start-ups, the food / nutrition scientist from Illinois Tech will have know-how and hands-on skill set to bridge fields in food product development, nutrition, processing technology, scale-up and value-added food and beverage products.

Chicagoland's Food & Beverage Industry

Since the mid-19th century, the Chicago region has been a center for food production and distribution – the place where much of the Midwest's agricultural output came to be processed, packaged and distributed to the marketplace. Today, Chicagoland's Food and Beverage industry is the second largest in the nation, trailing only Los Angeles. (2) Chicagoland has over 4,500 food industry establishments offering employment opportunities for students in food science and nutrition disciplines. These being food and beverage manufacturing, packaging, distribution and equipment.



(2) These figures are taken from *Chicagoland FOOD: Seizing the Opportunity to Grow Chicagoland’s Food Industry*.

With the introduction of the four year Food Science and Nutrition, the department will be able to recruit students who want a pathway into professional food industry positions. We anticipate total enrollment in Food Science and Nutrition programs will steadily increase as a result of the four year undergraduate FSN degree. This may also boost the FDSN graduate programs and result in higher visibility and healthy growth for the FDSN Department.

Classification of Instructional Programs (CIP) Code 01.1001

The proposed program is determined to be **Food Science** based on the following National Center for Education Services assignment, where Food Science is defined as:

“A program that focuses on the application of biological, chemical, and physical principles to the study of converting raw agricultural products into processed forms suitable for direct human consumption, and the storage of such products. Includes instruction in applicable aspects of the agricultural sciences, human physiology and nutrition, food chemistry, agricultural products processing, food additives, food preparation and packaging, food storage and shipment, and related aspects of human health and safety including toxicology and pathology.”

<https://nces.ed.gov/ipeds/cipcode/cipdetail.aspx?y=56&cip=01.1001>

The CIP codes are used as required to make the program US Financial Aid Eligible. The reader may refer to and find CIP codes at <http://nces.ed.gov/ipeds/cipcode>

PROGRAM VIABILITY

Competitive Programs: *Indicate other similar programs locally and nationally detail their success.*

Universities recognized by the Institute of Food Technologists (IFT) with qualifying undergraduate programs in food science are listed below. Most are not located in the heart of a robust food manufacturing hub such as here in Chicago. Rather, most benchmark universities are in rural/semi-rural agricultural regions and relatively far from thriving food processing or corporate food R&D centers. Given the proximity of Illinois Tech to the robust food industry sector, student opportunities for internships, food industry networking events and conventions abound. In the midwest, Purdue, University of Illinois, University of Wisconsin, Iowa State, and Ohio State are the closest in proximity to us. One of these pairs Nutrition Science with Food Science and none have designed an undergraduate program integrating design thinking strategies, data analytics, and regulatory science in the undergraduate experience and offer certificates and training for contemporary food systems management compliant with modernized food safety and labeling regulations.

IFT Undergraduate Food Science Universities - U.S.
Alabama A&M University
Auburn University
Brigham Young University
California Polytechnic State University
Clemson University
Cornell University
Iowa State University
Kansas State University
Louisiana State University
Michigan State University
Mississippi State University
North Carolina State University
Ohio State University
Oregon State University
Penn State University
Purdue University
Rutgers University
Texas A&M University
Tuskegee University
University of Arkansas
University of California- Davis
University of Delaware
University of Florida
University of Georgia
University of Idaho/ Washington State University
University of Illinois
University of Kentucky
University of Maine
University of Maryland
University of Massachusetts
University of Minnesota
University of Missouri
University of Nebraska-Lincoln
University of Tennessee
University of Wisconsin, Madison
University of Wisconsin-Stout
Utah State University
Virginia Tech

Estimation of Recruiting Base and Student Enrollment

The recruiting base for student enrollments will come from at least four sources: Graduating secondary schools, transfer students from community colleges, transfer students from other disciplines at IIT and other four year schools. The College Factual website, which reports on top food science schools across the nation, lists universities offering undergraduate degrees in Food Science, with approximately 1,509 students graduating into the field of food science annually. This figure closely matches data shown in the attached table published in 2017 by the National Center for Education Statistics (NCES). However,

the recruiting base for an undergraduate Food Science program is much larger than this figure in that it only represents the students that have committed and graduated from this discipline. From the same NCES data table calling out the related potential recruiting base figure of at least 150,000 can be derived. This is a reasonable recruiting field for US students in that Food Science represents an aggregate of such closely aligned disciplines.

Bachelor's, master's, and doctor's degrees postsecondary institutions: 2015-16

SOURCE: U.S. Department of Education, National Center for Education Statistics

Discipline division	Bachelor	Master	Doctor (1)
	Total	Total	Total
NOTE: All fields, (Not Shown here total In the full Source Table 318.30)	1,920,718	785,595	177,867
Agricultural and food products processing	98	0	0
Agricultural engineering	1,109	307	125
Bioengineering and biomedical engineering	6,531	2,359	1,045
Biological and biomedical sciences	113,749	15,714	7,914
Biological/biosystems engineering	284	22	21
Biology Human.....	838	0	0
Chemical and biomolecular engineering	159	29	20
Chemical engineering	9,751	1,653	981
Chemistry, general	13,855	2,327	2,774
Cognitive science	1,051	101	52
Culinary arts/chef training	365	0	0
Culinary science/culinology	65	0	0
Dairy science	133	29	10
Food science	1,503	416	157
Food science and technology, other	48	27	2
Food service systems administration/management	1,021	3	0
Food technology and processing	13	14	7
Foods, nutrition, and related services, other	29	49	0
Foods, nutrition, and wellness studies, general	2,725	612	40
Nutrition Human.....	774	293	29
Nutrition sciences	2,211	842	126
Poultry science	118	19	10
TOTAL for Fields Shown Above	156,430	24,816	13,313

(1) Includes Ph.D., Ed.D., and comparable degrees at the doctoral level. Includes most degrees formerly classified as first-professional, such as M.D., D.D.S., and law degrees.

NOTE: Data are for postsecondary institutions participating in Title IV federal financial aid programs. Aggregations by field of study derived from the Classification of Instructional Programs developed by the National Center for Education

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2016, Completions component. (This table was prepared August 2017.)
Table 318.30.

Market Analysis for Recruiting Students: *Detail what work has been done with UG Admissions to identify and recruit potential students.*

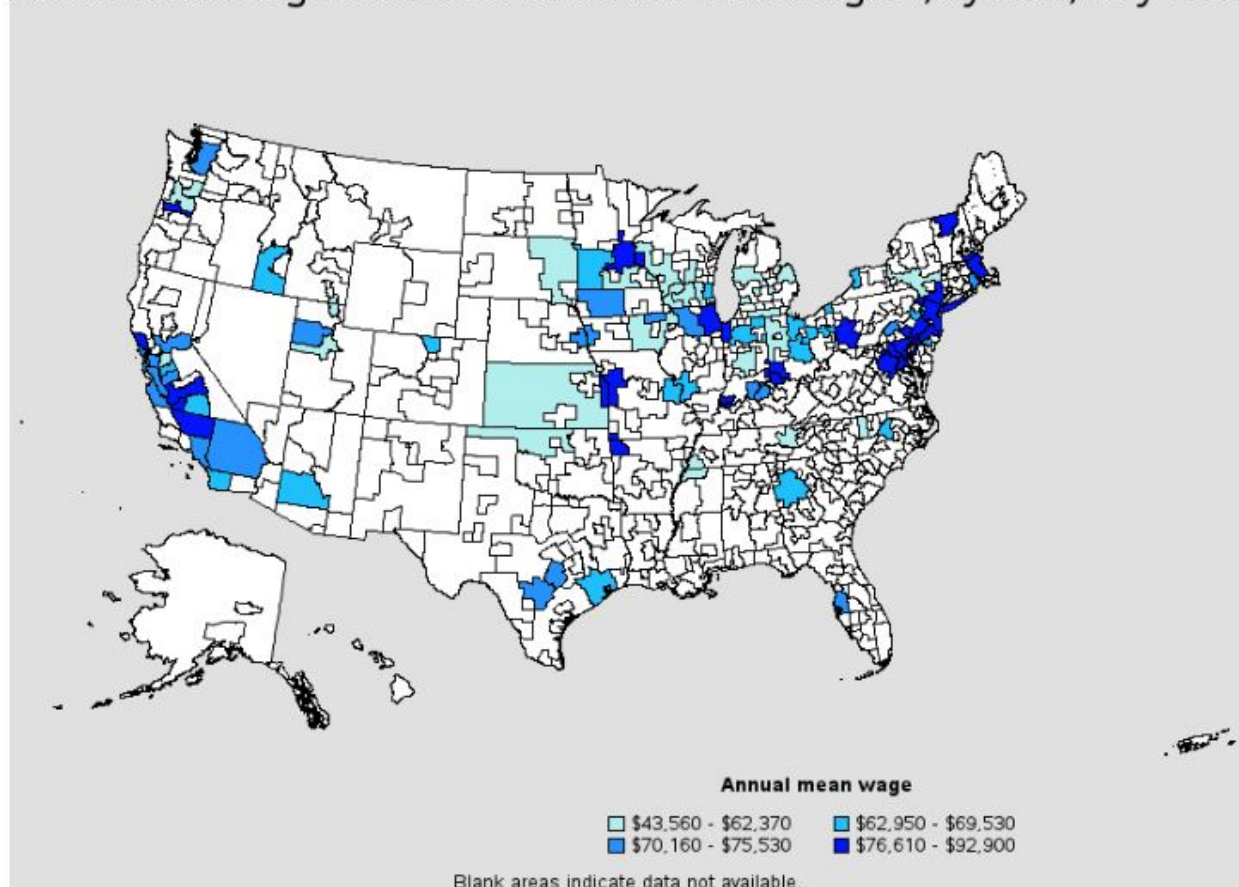
One of the potential challenges for UG admissions would be to distinguish the program from other universities with Food Science and Nutrition offerings. FDSN will prepare and provide marketing materials for the UG Admissions emphasizing its distinctive programming and learn-by-doing curriculum. Based on the data shown in the above table, it would be prudent to perform an analysis with Illinois Tech marketing to determine if a department name change to Food and Nutritional Biosciences or Food Science, Safety and Nutritional Biosciences might yield more applicants. However, this is not required to start our UG program as our current name (FDSN) is well recognized in the industry.

Market Analysis for Undergraduates: *Detail what work has been done with the Career Management Center to identify potential employment opportunities for graduates.*

According to Bureau of Labor Statistics, Greater Chicago area has the highest salary level in the US at \$92,900/year among Food Scientists and Technologists, and ranks the highest in the US for total jobs.

The FDSN Department will work closely with the Career Management Center to provide the UG program details and highlight the potential companies and industry liaisons.

Annual mean wage of food scientists and technologists, by area, May 2018



Top paying metropolitan areas for this occupation:

Metropolitan area	Employment (1)	Employment per thousand jobs	Location quotient (9)	Hourly mean wage	Annual mean wage (2)
Chicago-Naperville-Elgin, IL-IN-WI	650	0.14	1.51	\$44.66	\$92,900
Washington-Arlington-Alexandria, DC-VA-MD-WV	270	0.09	0.93	\$44.64	\$92,860
Boston-Cambridge-Nashua, MA-NH	280	0.10	1.11	\$43.07	\$89,580
Fayetteville-Springdale-Rogers, AR-MO	160	0.64	6.91	\$42.23	\$87,840
Minneapolis-St. Paul-Bloomington, MN-WI	(8)	(8)	(8)	\$41.95	\$87,260
Cincinnati, OH-KY-IN	180	0.17	1.80	\$41.64	\$86,600
Evansville, IN-KY	50	0.30	3.30	\$40.36	\$83,950
Kansas City, MO-KS	170	0.16	1.74	\$40.00	\$83,200
Fresno, CA	60	0.15	1.61	\$39.87	\$82,920
Baltimore-Columbia-Towson, MD	310	0.23	2.49	\$39.87	\$82,920

NOTE: The location quotient is the ratio of the area concentration of occupational employment to the national average concentration. A location quotient greater than one indicates the occupation has a higher share of employment than average, and a location quotient less than one indicates the occupation is less prevalent in the area than average.

Below is a short list of food companies located in Chicago, which are considered hiring prospects for Food Science and Nutrition majors.

Food Manufacturers in the Chicago Region
A. J. Canfield Company
Armour and Company
Brach's
Budlong Pickle Company
Carl Buddig
Chicago Bar Co.
Cloverhill Bakery
ConAgra
Curtiss Candy Company
Eli's Cheesecake
Ferrara Pan Candy Company
Fortune Brands
Fuhrman and Forster Company
Gonnella Baking Company
Goose Island Brewery
Kellogg's
Koval Distillery
Kraft Heinz Company
Kronos Foods
Land O'Frost
La Preferida
M&M/Mars
Mondelēz International
Morton Salt
Parker House Sausage Company
PepsiCo
Swift & Company
Tootsie Roll Industries
Upton's Naturals
Urban Accents
US Foods
Vanee Foods
Vienna Beef
Wm. Wrigley Jr. Company
World's Finest Chocolate

ACADEMIC INFORMATION

Enrollment Estimates: *Are there enrollment estimates for this program, and if so, what are they and what are they based on? What is the minimum number of students necessary in the program to make the program viable (i.e. to offer classes unique to the program often enough)?*

We are targeting 15 students the first year and 55 or more students by 2022. The first two years of the program (freshman and sophomore years) heavily lean on other disciplines, including chemistry, biology, physics, math, and the humanities as students complete their core requirements for Illinois Tech and for the FDSN degree. This will add revenue to those departments and allow for organized scheduling of existing and new FDSN courses.

We currently have 5 undergraduate courses we teach, supporting a minor in FDSN and the Behavior Health and Wellness degree program in Psychology. Class size ranges from 10-40 students per semester. These courses draw undergrads from all Illinois Tech Schools/Colleges.

Advising Strategy: *Since quality advising is a key component of good retention, graduation and career placement, how will students be advised and mentored? Specifically for interdisciplinary programs, how will advising responsibilities be shared? What student professional organizations will be formed? How will the department work with the Career Management Center to develop industry connections?*

As FDSN already manages MS, MAS, and PhD programs, existing advising procedures and strategies in the department will continue in this new degree program. Each student will have an academic faculty and staff advisor assigned in their first semester. Mandatory advising meetings will be enforced. Advising loads will be split among faculty. We will also institute a student mentoring program, where MS and PhD students will serve to help undergraduates navigate Illinois Tech, food industry interactions and experiences, and on campus research activities. Additionally, student mentors will engage undergraduates in the Food Science Club, currently all graduate students. Competitive events will be organized and encouraged. The IFT annual meeting is hosted in Chicago each summer, which will bring students back to their alma mater yearly.

Course Requirements: *Detail the courses needed for the program including courses currently offered, new courses to be developed (including syllabi), and dependence on courses from other academic units with their commitments to provide these courses on a long-range basis. Include descriptions of laboratories that will need to be developed along with equipment and facilities requirements.*

The Bachelor of Science in Food Science and Nutrition is built on the following premises:

1. Because of the multidisciplinary nature of food science and nutrition, the departmental course offerings for the FDSN degree rest firmly on prerequisite courses already found in math and sciences at Illinois Tech.
2. Our programs are strongest when we leverage the expertise across all of Illinois Tech. Emphasis has been given to provide coursework that bridges many different disciplines within the university. We believe this strengthens not only FDSN students, but the students from those disciplines who will have access to FDSN offerings in turn.
3. Preeminent food science programs in the United States most often meet the requirements of the Institute for Food Technologists (IFT) Higher Education Review Board (HERB), which rigorously assesses undergraduate food science programs to meet its high IFT Undergraduate Education Standards for Degrees in Food Science. We have structured our program to also meet those requirements. This will enable our program to be listed among the IFT approved programs and thus gain better visibility with IFT's 16,000 members, provide IFT scholarship opportunities to our students, and create more job opportunities through IFT's job board (~500 job postings in 2018).

Facilities and Lab Requirements

Based on anticipated enrollments, lecture facilities to accommodate in-class seating for 20-30 students per class session with adequate digital capabilities for audio-visual media presentations will be required. The following laboratory types for 20 students per lab class will be required:

- 1) Food Chemistry/ Food Analysis/ Food Properties Labs: Standard wet chemistry lab amenities - Wet chemistry certified lab benches, cabinets, sinks, eye wash stations, chemical storage, fume hood, refrigerator / freezers for food material storage, variety of analytical instrumentation, including HPLC, GC MS, spectrophotometers, pH meters, colorimeter, vortex, water baths, sonicators, Soxhlet and Kjeldahl apparatus', vacuum dryer, moisture dryer, distilled water system, lyophilizer, analytical scales, among other equipment.
Food Properties Lab that includes small equipment such as food colorimeter, refractive index unit, water activity, rheological analyzer, texture analyzer, pH meter, and more.
- 2) Bio- and clinical- chemistry laboratory: Standard wet biochemistry lab amenities, much of which is similar to wet chemistry needs, including certified lab benches, cabinets, sinks, eye wash stations, chemical storage, fume and biologics hoods, centrifuges, analytical scales, microscopes, vortex machines, pipettes, water baths, etc. In addition, cell culture capability, electrophoresis, microplate washers and readers, freezers, refrigerators.
- 3) Food Innovation Kitchen and Lab: Laboratory space for students to have hands on development training working with food, understanding how food chemistry is leveraged to develop food products with specific requirements to meet consumer demands. The kitchen lab should be culinary grade kitchen space compliant with Illinois State Dept. Public Health code to allow for tasting and food consumption. Individual food handling/ cooking stations with instructor demonstration island is required. An applications lab like this will leverage the Food Properties lab to create real world experiences for students as they verify and document specifications requirements objectively, Refrigerators and freezers sized to support course load requirements. Wet mop sink, culinary grade

flooring, ventilation for odor control, variety of kettles, cookers, mixers and smallwares. (See sample detail for Food Innovation Kitchen and Food Properties Lab)

- 4) Food Operations/ Unit Operations Pilot Plant: A food-grade pilot plant space sized to accommodate R&D scale unit operations sufficient to demonstrate and handle food materials at least in the following processes: thermal, non-thermal, freezing, dehydration, mixing, blending, pumping, conveying and packaging. The pilot plant should also support demonstrations of equipment and plant sanitation protocols. This type of pilot plant is located on the IIT Moffett Campus in Bedford Park, IL and requires students to travel for courses which use this facility.
- 5) Food Microbiology labs: A microbiology laboratory space for students to study microorganisms and their reaction to foods and their environments. The lab will need appropriate equipment for testing / detecting / tracking spoilage and pathogenicity, predicting microbial growth and death with computer models, understand genetic basis for pathogenicity and the reaction of microorganisms to new preservation methods, inhibitors, and stressors impacting survival. Homogenizers, dilution machines, dispensers, and labelers, microscopes, automated PCR machines for DNA amplification to identify of pathogens, centrifuges, hoods, incubators, along with basic items such as analytical scales, test tubes, petri dishes, pipettes, and spatulas are also used in food microbiology labs. Currently all food microbiology labs are held at the IIT Moffett campus as part of the IFSH laboratory space and requires students to travel for courses which use this facility.

Instruction Resources

The department currently has 8 tenure/tenure track faculty, 1 teaching faculty professor, and 2 full time staff who are also adjunct industry professors. We also have one teaching faculty from INTM who serves as an adjunct in our dept, one IFSH engineer who teaches as a lab class as needed, and 3 other adjunct faculty from outside Illinois Tech who contribute to our program. With new courses in development (n=15), this will greatly increase the teaching load of our current faculty. Each faculty member would be required to teach a minimum of 2 additional courses on top of their current teaching load. For our most research active faculty, this will be extremely difficult. Byouts will be required to hire adjunct faculty for faculty relief. As the program grows, faculty lines will be requested to broaden the scope of our department and help with instruction. Teaching assistantships will be required, especially for laboratory courses, which are labor intensive and require more one-on-one with students. Our MS and PhD programs will be ideal for teaching assistantship resourcing and augmenting faculty instruction.

FDSN Requirements

Program Core Courses (39 credits)

Existing Courses (9 credits)

- FDSN 201 Nutrition and Wellness
- FDSN 300 Nutrition through the Life Cycle
- FDSN 401 Nutrition, Metabolism and Health

New Courses (30 credits)

- FDSN 100 - Introduction to the Profession
- FDSN 3xx - Food Chemistry with Lab
- FDSN 3xx - Food Analysis and Properties
- FDSN 3xx - Food Law, Labels, and Health Claims
- FDSN 304 - Food Biotechnology

- FDSN 4xx - Food Plant Operations
- FDSN 4xx - Preservation Processing
- FDSN 4xx - Food Microbiology with Lab
- FDSN 4xx - US Food Safety Regulatory Systems
- FDSN 4xx - FDSN Capstone (students choose based on focus area - FSMA or Human Nutrition)

Program Electives (students choose 15 credits)

- FDSN 2xx – Introduction to Culinology
- FDSN 301 – Fundamentals of Food Science and Technology (existing)
- FDSN 3xx - Food and Natural Products Toxicology
- FDSN 3xx - Sustainable Food Systems
- FDSN 3xx - Cultural Foods with Lab
- FDSN 3xx - Culinary Entrepreneurship
- FDSN 3/4xx - Food Fermentation (w/lab and plant field trips)
- FDSN 4xx - Introduction to Food Design
- FDSN 403 - Food and Behavior (existing)
- FDSN 4xx - Management of Food Quality Control

Through other academic units (74+ credits):

The courses required through other academic units are all standard courses at Illinois Tech offered/required across a wide variety of programs.

- CHEM 124 Principles of Chemistry I with Laboratory
- CHEM 125 Principles of Chemistry II with Laboratory
- CHEM 237 Organic Chemistry (with lab)
- CHEM 239 Organic chemistry II or CHEM 247 Analytical chemistry or BIOL 214 Genetics or BIOL 403 Biochemistry or 404 Biochemistry Lab (404 with permission) or BIOL 430 Human Physiology (with permission)
- BIOL 107 General Biology Lectures
- BIOL 210 Microbiology
- MATH 151 Calculus I
- MATH 152 Calculus II
- MATH 225 Introductory Statistics or MATH 425 Statistical methods or MATH 426 Statistical tools for Engineers
- PHYS 123 Gen Physics I: Mechanics
- PHYS 221 Gen Physics II: Electricity and Magnetism
- COM 101 Writing in the University
- CS 105 Intro to computer programming or CS 110 Computing Principles
- ID 400+ (e.g., 410 Intro to Design Processes or ID 420 Fundamentals of Design)
- ECON 100/200 (e.g., ECON 151 Microeconomics or ECON 211 Principles of Economics)
- BUS 300+ (e.g. BUS 382 Business Economics or BUS 210 Accounting for non-business major or BUS 305 Operation and Supply Chain Des (requires prereqs – work with advisor))
- INTM 300+ (e.g. INTM 406 Quality Control or INTM 410 Operations Management)
- PSYC 300+ (e.g., PSYC 301 Industrial Psychology, PSYC 310 Social Psychology, PSYC 414 Neural & Bio bases Behavior, PSYC 423 Learning Theory, PSYC 426 Cognitive Science)
- IPRO Elective 1 and IPRO Elective 2

- Humanities 200-Level course
- IIT Human Sciences Module (18 credit hours)

Note: 36 credits must be (C) designated. Some FDSN courses will apply for C designation

New FDSN Course Descriptions

Core Courses

FDSN 100 - Introduction to the Profession

In this course students will survey the professional landscape of the food industry. The course provides an introduction to the different career roles and opportunities within the food industry. The rich Chicago food industry will serve as a backdrop to learn about the current and emerging food ecosystem. Students will hear from industry guest speakers about the legacy and latest start-up enterprises that comprise various professional paths. Field trips to local food business incubators and food processing plants are planned. The course will also provide an introduction to food regulations.

3.000 Credit hours

3.000 Lecture hours

FDSN 3XX - Food Chemistry with Lab

The course applies basic scientific principles to food systems and practical applications.

Chemical/biochemical reactions of carbohydrates, lipids, proteins, and other constituents in fresh and processed foods are discussed with respect to food quality. Reaction conditions and processes that affect color, flavor, aroma, texture, nutrition, and safety of food are emphasized. Other topics include activation and control of enzymatic reactions in fruits and vegetables; consequences of water migration on food quality; gelatinization-retrogradation in starch-based foods (e.g., pudding, bread, and rice); initiation and control of non-enzymatic browning (e.g., pretzels, meat); food emulsions (e.g., salad dressings, commutated meats products), crystal structures in foods and general properties of food materials. The interaction of food components with packaging and the environment will be examined.

3.000 Credit hours

2.000 Lecture hours

1.000 Lab hours

FDSN 3XX - Food Analysis and Properties

In this course students will learn about the physical and chemical properties of foods that can be instrumentally measured as a means to derive product and ingredient specifications. Such measurements enable the food industry to define foods on an objective basis and meet regulatory requirements for food labeling. Properties such as color, acidity, total solids, viscosity, water activity, particle size and moisture content will be demonstrated in a hands-on lab experience setting. This course will also cover the types of instrumentation used for nutritional label contents (protein, fat, sugars, salt etc.) versus that used for research purposes and trouble-shooting for product design issues.

3.000 Credit hours

3.000 Lecture hours

FDSN 3XX - Food Law, Labels, and Health Claims

This course is designed to give students an in depth understanding of food laws and regulations that govern the food and dietary supplement industries. Students will apply their knowledge in simulated and real world experiences preparing students for rigid food safety requirements and navigating the complex landscape of food labels, including Health and related claims and communications.

FDSN 304 Food Biotechnology

This course is designed for undergraduate students to learn various biotechnologies and applications used by modern food industry. These may include but limited to genetic engineering of microorganisms, polymerase chain reaction, molecular detection, DNA fingerprinting, and epidemiology of foodborne pathogen, genetically modified organisms (GMOs), food plant biotechnology, dairy and animal biotechnology, biotechnology in fermentation industry and dietary supplements, consumer perspectives and governmental regulations of GMOs, organic foods and more. Also covered in this course: fundamentals of microbial genomics and proteomics, introduction of bioinformatics tools including database search, gene prediction, PCR primer design, structural and functional prediction of proteins. Also examined are applications of high-throughput sequencing technology and data security in food safety and public health sectors.

Prerequisite: Biology or Microbiology

3.000 Credit hours

3.000 Lecture hours

FDSN 4XX - Food Plant Operations

The food processing line types for the major food and beverage manufacturing segments are reviewed as integrated systems. The unit operations specific to each of the dairy, meat, poultry, seafood, juice, bakery and produce industries are reviewed. Students will each draft their own virtual commercial plant layout using vendor equipment specifications with principles of mass balance of material inputs and outputs. Industry guest speakers and trips to local food plants will provide real-world exposure to current manufacturing issues. Principles of plant layout for Good Manufacturing Practices, sanitation, and material flow through the plant will be highlighted. Trends in digitalization of the food plant and plant operations using Industry 4.0 concepts will be discussed.

3.000 Credit hours

3.000 Lecture hours

FDSN 4XX - Preservation Processing

This course will cover the fundamental aspects of food preservation, various methods used in food preservation, and engineering calculations related to preservation processing. Perishability of different categories of food products, shelf life, microbial growth and spoilage in foods; Principles of mass and energy balance, heat transfer, and fluid flow; preservation by heat (canning, blanching, pasteurization); preservation by additives (chemical preservatives, antimicrobials, bio preservatives), preservation by pH (addition of acids, fermentation), novel methods of food preservation; preservation by temperature reduction (freezing, refrigeration); thermal process engineering calculations; preservation by water activity (dehydration, drying, evaporation, the addition of salt or sugar); preservation by other conventional methods (smoking, pickling, etc.); food packaging as a preservation aid; preservation by novel food processing technologies; special considerations for the preservation of various food products; validation of preservation.

3.000 Credit hours
3.000 Lecture hours

FDSN 4XX - Food Microbiology Lecture and Laboratory

In this course, students will build upon the basic principles of microbiology. Students will explore the intrinsic and extrinsic parameters that affect microbial survival, growth, and inactivation. Students will learn about beneficial bacteria used as probiotics and fermentative microorganisms. Students will learn about foodborne spoilage microorganisms associated with common food commodities. Major foodborne pathogenic microorganisms (their habitats, dissemination, symptoms, and potential mitigation strategies) will be discussed in depth. Methods to assess the microbiological quality and safety of foods will be investigated via hands on experimentation.

3.000 Credit hours
2.000 Lecture hours
1.000 Lab hours

FDSN 4XX - US Food Safety Regulatory Systems

This course gives a broad overview of the food safety regulatory systems in the US. It will cover the roles of FDA, USDA, EPA, CDC, DoC in regulating the production and sale of food. Regulations covered include Low Acid Canned Foods, HACCP, dietary supplements, infant formula, food additives and packaging, and the six parts of the Food Safety Modernization Act (FSMA).

3.000 Credit hours
3.000 Lecture hours

FDSN 4XX - FDSN Capstone

Students choose one of two options based on area of focus: FSMA or Human Nutrition.

The FSMA capstone will include hands-on team-based practical experience implementing the Food Safety Modernization Act (FSMA) Preventative Controls for Human Foods. The experience will involve the drafting a food safety plan consistent with current laws and regulations.

The human nutrition capstone will be a hands-on team-based practicum designing foods for specific claims petition, including developing validation strategy and drafting appropriate claims petition consistent with current law/regulations.

Program Electives (students choose 15 credits)

FDSN 2XX - Introduction to Culinary

This course gives a broad overview of the new field of culinology: the blending of culinary arts and food science training. Topics include Principles of Cooking, Formula and Recipe Development, Culinary Fundamentals and Production Systems, Culinary Uses and Applications of Products, Flavor Building, and Functional Ingredients, and how these all integrate with Food Safety and Sanitation Principles.

2.000 Credit hours

2.000 Lecture hours

FDSN 3XX - Food and Natural Products Toxicology

Food toxicology is concerned with assessing the injurious effects on living systems of chemicals present in foods. The chemical agents can be man-made (e.g., pesticide residues, food additives, contaminants originating with processing machinery, or packaging materials) or of natural origin (e.g., microbial, animal or plant derived). They can also be generated in the course of preparing, processing, and preserving foods (e.g., mutagens and carcinogens). This course presents the chemical and biological principles that determine toxicity and, by presenting typical examples of the toxic substances found in foods, it hopes to let students become familiar with their properties, modes of action, and methods of analysis.

3.000 Credit hours

3.000 Lecture hours

FDSN 3XX - Sustainable Food Systems

This course is designed to give students an appreciation of the complex intersections and relationships among food and culture, economics, the environment, labor, policy, population health, and social justice. Students will have opportunities to work on projects that model and analyze these relationships, and consider trade-offs impacting production and consumption, global nutrition and health, scarcity in resources, and more. Students will visit urban and rural farms, introduced to alternative farming techniques and their challenges, how sustainability is measured and reported in the food and related industries.

3.000 Credit hours

3.000 Lecture hours

FDSN 3XX - Cultural Foods with Lab

This course examines the regional, ethnic, cultural, religious, historical and social influences on food patterns and cuisine. Students will study cultural food and nutrition principles related to the following topics: Food as identity and food in social organization Evolutionary and revolutionary developments in food and cuisine Food as spectacle Food technology in non-industrialized and industrialized food systems Food and health: political inputs and obesity Food branding and marketing Food in world religions Global hunger: root causes and proposed solutions Hunger in America and food and social change.

3.000 Credit hours

2.000 Lecture hours

1.000 Lab hours

FDSN 3XX - Culinary Entrepreneurship

This course surveys the new trends in food business entrepreneurship from a culinary perspective. Guest speakers with backgrounds in food science and culinary arts will review the steps in taking a kitchen recipe concept into the local marketplace. Topics will include formulating your business plan, preparing the product pitch for investors, choosing when to work with a shared kitchen versus a food incubator space, when and how to use consultants, building a support team and how to scale the product. Local chef and food entrepreneurs will co-instruct this course and students will visit several of Chicago's start-up entrepreneurial centers.

3.000 Credit hours

3.000 Lecture hours

FDSN 3/4XX - Food Fermentation (w/lab and plant field trips)

Role and history of fermentation; the role of microorganisms in fermentation; microbial growth kinetics during food fermentation; biological pathways in fermentation; factors affecting fermentation; fermented food products; industrial-scale fermentation; operation of fermenter; the role of sterilization in fermentation; design of a fermenter; role of different types of fermentation (alkaline, alcoholic, acetic acid, high salt, savory fermentation). Students will explore processing of fermented foods via in class and hands on learning experiences.

3.000 Credit hours

2.000 Lecture hours

1.000 Lab and field trips

FDSN 4XX - Introduction to Food Design

Food design is a relatively new field to the food industry but is increasingly a critical aspect of bringing a successful food product to market. Students will learn the basic tools of human centric design thinking. This will include how to gain insights from observing and listening to the consumer. Skills for understanding unmet needs and how to frame the problem will be taught through team product design challenges sourced from the local community. Teams will have the opportunity to validate their design concepts to invited industry mentors. This course is co-taught with the IIT Design Institute in the Kaplan Institute.

3.000 Credit hours

3.000 Lecture hours

FDSN 4XX - Management of Food Quality Control

This course centers on the modern food processing facility which requires full time quality control management. A unique QC lab mock-up is used to provide a hands-on training experience to prepare the student for management of a QC lab. Taught by faculty with in-plant experience, students will learn how to select and integrate modern ingredient and finished product test methods with operational data from the production line. Statistical Process Control (SPC) charting methods, design of sampling protocols, handling of retention samples, dealing with product recall plans, record keeping and management of consumer complaint data will be discussed.

3.000 Credit hours

3.000 Lecture hours

Sample Curriculum/Program Requirements: Provide a sample semester by semester curriculum and the program requirements, as they would appear in the IIT Undergraduate Programs bulletin.

Food Science and Nutrition Requirements		(54)
<i>Students must take each of the following:</i>		(39)
FDSN 100	Introduction to the Profession	3
FDSN 201	Nutrition and Wellness	3
FDSN 300	Nutrition through the Life Cycle	3
FDSN 3XX	Food Chemistry with Lab	3
FDSN 3XX	Food Analysis and Properties	3
FDSN 3XX	Food Law, Labels, and Health Claims	3
FDSN 304	Food Biotechnology	3
FDSN 401	Nutrition, Metabolism and Health	3
FDSN 4XX	Food Plant Operations	3
FDSN 4XX	Preservation Processing	3
FDSN 4XX	Food Microbiology with Lab	3
FDSN 4XX	US Food Safety Regulatory Systems	3
FDSN 4XX	FDSN Capstone	3
<i>Students must take 15 credits from the following:²</i>		(15)
FDSN 2XX	Introduction to Culinology	2
FDSN 3XX	Culinary Entrepreneurship	3
FDSN 301	Fundamentals of Food Science and Technology	3
FDSN 3XX	Food and Natural Products Toxicology	3
FDSN 3XX	Sustainable Food Systems	3
FDSN 3XX	Cultural Foods with Lab	3
FDSN 3XX	Introduction to Food Design	3
FDSN 3/4XX	Food Fermentation (w/lab and plant field trips)	3
FDSN 403	Food and Behavior	3
FDSN 4XX	Management of Food Quality Control	3

Chemistry Requirements		(12)
CHEM 124	Principles of Chemistry I with Laboratory	4
CHEM 125	Principles of Chemistry II with Laboratory	4
CHEM 237	Organic Chemistry I	4
Biology Requirements		(6)
BIOL 107	General Biology Lectures	3
BIOL 210	Microbiology	3
CHEM/BIO Technical elective		(3-4)
CHEM 239 or CHEM 247 or BIOL 214 or BIOL 430 or BIOL 403 or BIOL 404	Organic chemistry II Analytical chemistry Genetics Human Physiology (with permission) Biochemistry Biochemistry Laboratory (with permission)	3-4
Mathematics Requirements		(8)
MATH 151 or MATH 152	Calculus I Calculus II	5
MATH 225 or MATH 425 or MATH 426	Introductory Statistics Statistical methods Statistical tools for Engineers	3
Physics Requirements		(4)
PHYS 123	Gen Physics I: Mechanics	4
Computer Science Requirement		(2)
CS 105 or CS 110	Introduction to Computer Programming Computing Principles ¹	2
Additional Electives		(12)
Select 12 credit hours ²		12
Humanities and Social Science Requirements		(21)
See Illinois Tech Core Curriculum, sections B and C		21
Interprofessional Projects (IPRO)		(6)

See Illinois Tech Core Curriculum, section E	6
Total Credit Hours³	128-129

¹ These may change with new course offerings pertinent to the food and related industries.

² Additional electives must be chosen from the following: ID 400+, ECON 100/200, BUS 300+, INTM 300+, PSYC 300+, PHYS 221 (requires MATH 152).

³ If COM 101 is required, total credits will increase to 131-132.

Sample Curriculum

First Year

First Semester	Credits	Second Semester	Credits
FDSN 100	3	BIOL 107	3
MATH 151	5	CHEM 125	4
CHEM 124	4	COM 101	3
CS 105 or 110	2	<i>Social Sciences Elective</i>	3
PHYS 123	4	<i>Humanities 200 level course</i>	3
	18		16

Second Year

First Semester	Credits	Second Semester	Credits
FDSN 201	3	FDSN 300 (Nutrition through the Life Cycle)	3
CHEM 237	4	MATH 225	3

BIOL 210	3	FDSN Elective	3
Additional Elective	3	FDSN 3XX (Food Chem w/Lab)	3
<i>Humanities or Social Sciences Elective</i>	3	<i>Humanities Elective (300+)</i>	3
	16		15

Third Year

First Semester	Credits	Second Semester	Credits
FDSN 304 (Food Biotech)	3	FDSN 401 (Nutrition, Metabolism and Health)	3
FDSN 3XX (Food Analysis and Prop)	3	FDSN Elective	3
FDSN 3XX (Food Law, Labels, and Health Claims)	3	Additional Elective	3
FDSN Elective	3	IPRO Elective 1	3
Additional Elective	3	Additional Elective	3
<i>Humanities Elective (300+)</i>	3	<i>Social Sciences Elective (300+)</i>	3
	18		18

Fourth Year

First Semester	Credits	Second Semester	Credits
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FDSN 4XX (US Food Safety Regulatory Systems)	3	FDSN 4XX (Preservation Processing)	3
FDSN 4XX (Food Plant Operations)	3	FDSN 4XX (Food Micro w/lab)	3
FDSN Elective	3	FDSN 4XX (FDSN Capstone)	3
CHEM/BIO Technical elective	3-4	FDSN Elective	3
<i>Social Sciences Elective (300+)</i>	3	IPRO Elective 2	3
	15-16		15

Total Credits 132

Program Outcomes and Assessment Process: *Provide the program learning goals and assessment plan (for more information contact the Assessment Office within Academic Affairs).*

Also see <https://sites.google.com/a/iit.edu/student-learning-assessment/>

The educational objective of the FDSN undergraduate program is to produce graduates who are prepared to:

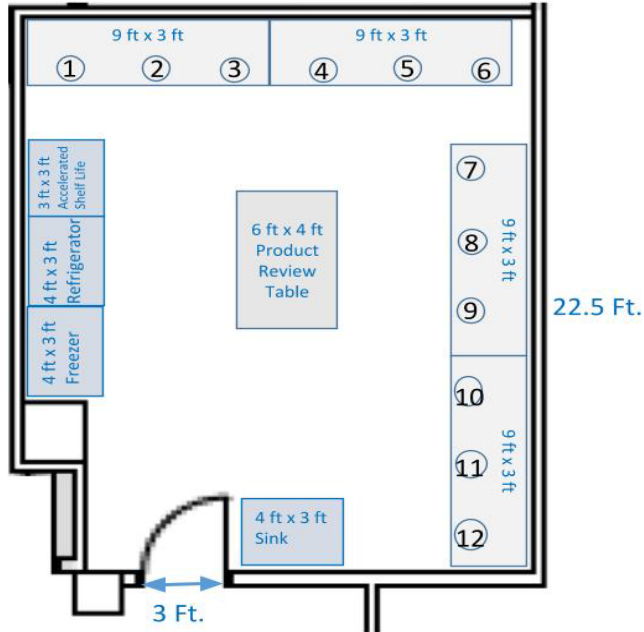
1. Meet the expectations of the food industry and related employers.
2. Pursue advanced study if they so desire.
3. Assume leadership roles in their communities and/or professions.

Rubrics are being compiled to measure the success of the department in achieving these learning goals. The department will choose one course each semester and perform an assessment on one artifact in each course using the appropriate rubric. This assessment will be communicated to the University Assessment Office on an annual basis.

In Process – Facilities and Lab Requirements: Sample Detail Food Properties Lab

Food Properties Lab Suggested Layout

18.2 Ft.



Legend

1. Food Colorimeter
2. Refractive Index Unit
3. Texture Analyzer
4. Stomacher
5. Petrifilm Unit
6. Bench top incubator
7. Scale
8. Gas Headspace Analyzer
9. Moisture Analyzer
10. Water Activity unit
11. Viscometer
12. pH Meter

Facilities and Lab Requirements: Sample Detail FIT Kitchen Lab

