

# MICHIGAN STATE UNIVERSITY

December 19, 2012

## MEMORANDUM

TO: Dr. Douglas Estry, Associate Provost for Undergraduate Education  
and Dean of Undergraduate Studies

FROM: Dr. Linda O. Stanford, Associate Provost for Academic Services

RE: Request for a New Undergraduate Specialization in Beverage Science  
and Technology

For Transmittal to the University Committee on Undergraduate  
Education (UCUE)

The request referenced above is being sent to the University Committee on Undergraduate Education (UCUE) in accordance with the *Bylaws for Academic Governance*, 4.4.

### UCUE Response Requested:

Please ask the committee to consider the request referenced above and provide consultative commentary. Please mail the related materials referenced under the heading Attachments at the end of this memorandum to the committee members.

After receiving the committee's consultative response, the Provost will make a determination to forward or not to forward the request to the University Committee on Curriculum for its approval of curriculum and degree requirements.

If you have any questions, please call Joy Speas, University Curriculum Administrator, at 5-8420.

Thank you.

### Attachments:

1. Request to Establish a New Academic Program form dated October 16, 2012: Undergraduate Specialization in Beverage Science and Technology and attachments.

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## University Curriculum and Catalog

Hannah Admin. Building  
426 Auditorium Road  
Room 176  
East Lansing, MI 48824

517-355-8420  
Fax: 517-353-1935

## COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

1. Request to establish a **Specialization in Beverage Science and Technology** in the Department of Food Science and Human Nutrition. The University Committee on Undergraduate Education (UCUE) will consider this request at its January 10, 2013 meeting.

- a. **Background Information:**

The production of beverages by fermentation is an important and growing industry in the State of Michigan and the United States. In particular, there is a demand for individuals with a strong technical background in the small scale, craft or artisan brewing (90 Michigan producers), winemaking (90 Michigan producers), cider (125 Michigan producers), and distilling (25 Michigan producers) industries. The Specialization in Beverage Science and Technology is designed to provide students with a level of training that will prepare them to enter employment in these industries. Students will gain the understanding of the legal aspects for production, distribution, and retail use of fermented beverages.

There is no similar program at Michigan State University to prepare professionals in the science and technology required to manufacture fermented beverages. No other institution in the State of Michigan offers such a program. The University of California-Davis and Cornell University have programs targeted or have programs with a focus of the wine production industry. The proposed specialization will offer a broad background with its corresponding greater employment opportunities.

There are no known existing accreditation agencies for the proposed program. Alcoholic beverage production is heavily regulated by the federal government, but there are no regulations associated with academic programs beyond requirements of local licensed facilities which have been recently reviewed by the Michigan State University Office of General Counsel to assure conformance.

- b. **Academic Programs Catalog Text:**

The Specialization in Beverage Science and Technology is designed to provide students with fundamental knowledge of the production of fermented beverages. Certain courses in this specialization are only offered at off-campus wineries or breweries. The specialization is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University. The specialization is administered by the Department of Food Science and Human Nutrition.

With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

### **Requirements for the Specialization in Beverage Science and Technology**

CREDITS

Students must complete 15 credits from the following:

1. One of the following courses (3 credits):

FSC	342	Food Safety and Hazard Analysis	
		Critical Control Point Program	3
MMG	201	Fundamentals of Microbiology	3
MMG	301	Introductory Microbiology	3
2. One of the following courses (3 credits):

HB	409	Introduction to Wine	3
HRT	430	Exploring Wines and Vines	3
3. All of the following courses (9 credits):

CEM	482	Science and Technology of Wine Production	3
CHE	483	Brewing and Distilled Beverage Technology	3
FSC	481	Fermented Beverages	3

Effective Fall 2013.

<b>View a Program</b>		<b>Main Menu</b>
Joy Speas, RO	Tuesday, 10/16/2012	
<b>Program Name: Specialization in Beverage Science and Technology</b> <b>Degree: SPCU Sequence Number: 1</b>	Program Request ID: 2163	
<b>Effective Dates: Fall 2012 - Open Status: Interim Initial Action: New</b>		
<b>Requested Date: 1/20/2012 1:27:50 PM</b>		
<p><b>1. Department/School/College:</b> 02348 .... Department of Food Science and Human Nutrition</p> <p><b>2. Name of Program:</b> Specialization in Beverage Science and Technology</p> <p><b>3. Name of Degree:</b> SPCU</p> <p><b>4. Type of Program:</b> Other</p> <p><b>5. Effective Start Semester:</b> Fall <del>2012</del> <i>2013</i></p> <p><b>6. Target student audience for the program:</b> Biosystems Eng., Chemistry, Chem. Eng., Food Science, Horticulture, Microbiology</p> <p><b>7. Enrollment:</b> <b>What is the expected enrollment per year: 10</b> <b>What is the minimum enrollment acceptable: 5</b></p> <p><b>8. Source of budget for the program:</b> To align academic planning and curricular change, ALL requests for NEW funds must be included in the College's annual planning letter. Provost approval of new funds and the effective date for the new program must align. If funding is not approved, then the program request will not be forwarded to Faculty Senate.  Internal reallocation  If new funds, was this request included in the College's annual planning letter? Indicate yes or no. If no, then this is a department or college fund reallocation (If the program is implemented, no additional resources are required.).</p> <p><b>9. Projected Costs as compared to other programs in unit:</b> Lower</p> <p><b>10. Staff requirement:</b> How many additional staff will be required: 0  Who will provide the primary instruction. Describe any external linkages(industry,</p>		

government, etc.):  
Kris Berglund, PhD, FSHN

**11. Will additional equipment be required:**

Approximate cost: 0

Source of funding:

**12. Will additional library materials be required:**

Approximate cost: 0

Source of funding: None

**13. Will additional space be required:**

Type:

Approximate amount:

**14. If the program requirements contain a named concentration, do you wish for the concentration to be noted on the student's transcript?:**

No

**15. Detailed Description:**

a. The production of beverages by fermentation is an important and growing industry in the State of Michigan and the United States. In particular, there is a demand for individuals with a strong technical background in the small scale, craft or artisan brewing (90 Michigan producers), winemaking (90 Michigan producers), cider (125 Michigan producers) and distilling (25 Michigan producers) industries. It is the goal of the MSU BS Specialization in Beverage Science and Technology to provide students with a level of training that will prepare them to enter employment in these industries.

There is no similar program offered at MSU to prepare professionals in the science and technology required to manufacture fermented beverages. No other institution in the State of Michigan offers such a program. The only programs that are related (e.g. University of California. Davis and Cornell University) are aimed at the wine production industry. The proposed program will offer MSU a broader background with its corresponding greater employment opportunities.

There are no known existing accreditation agencies for the proposed program. Alcoholic beverage production is heavily regulated by the Federal government, but there are no regulations associated with academic programs beyond requirements of licensed facilities which have been recently reviewed by MSU's Office of General Counsel to assure conformance.

b. As the Land Grant University for the State of Michigan, MSU is uniquely positioned to undertake a program that combines elements of production agriculture and food manufacturing.

c. The Department of Food Science and Human Nutrition at MSU has a long history in training of the manufacturing of food products. It is the appropriate primary administrative unit for the program.

d. Upon completion students should have the following skills:

1. Understanding of the legal aspects for production, distribution, and retail use of fermented beverages.

2. Understanding of the science and technology of the commercial production of wine, brewed beverages (beer and cider), and distilled spirits including production methods and quality control/ quality assurance.

These skills sets are appropriate for professionals wishing to gain entry level positions on the fermented beverage industry.

e. Kris Arvid Berglund, University Distinguished Professor of Food Science and Chemical Engineering.

f.

## Michigan State University

### Assessing Student Outcomes

College: Agriculture and Natural Resources  
 Department: Food Science and Human Nutrition  
 Program or Major: BS Specialization in Beverage Science and Technology  
 Program Level: BS  
 Contact Person: Kris A. Berglund

#### Inventory of Written Statements and Plans

1. Do you have a written mission statement or statement of purpose?  yes  no  
 If yes, please attach a copy or reference where this can be found:  
**Attached**
2. Do you have a written statement of intended educational outcomes describing what a student should know or be able to do when they have completed this program?  yes  no  
**Attached**
3. Do you have a written method of assessment for measuring student  yes  no

outcomes?

4. Does your program have a separate accreditation process? yes   x   no  
 If yes, please list all accrediting agencies below:

### Assessment Methodologies

It is likely that some assessment measures are already in place in this program even if they are not identified as being part of a formal assessment plan. Listed below are some of the assessment methodologies you may be using. Indicate "A" if the method is currently being used; "B" if it is **not** being used but you are interested in using it; and "C" if the method of assessment does not apply to your program.

#### Direct Methods of Assessment

1. A Comprehensive Examinations
2. C Writing proficiency Examinations
3. C National Examinations assessing subject matter knowledge
4. C Graduate Record Exam General Test
5. C Graduate Record Exam Subject Test
6. C Certification Examinations
7. C Licensure Examinations
8. A Locally developed pre-test or post-test for subject matter knowledge
9. B Senior thesis or major project
10. C Portfolio evaluation of student work
11. C Capstone courses
12. C Audio or Video tape evaluations

#### Indirect Methods of Assessment

1. C Comparison or benchmarking with peer institutions
2. A Job placement of graduates
3. B Employer surveys
4. B Advisory groups from your profession
5. C Graduate school acceptance rates
6. C Student graduation/retention rates
7. C Exit interviews with students graduating or leaving the program
8. B Student satisfaction surveys
9. A Student course evaluations
10. C Focus group discussions
11. B Alumni surveys
12. C Alumni honors, awards, achievements
13. C Analysis of grade distributions
14. C Peer review of courses
15. C Peer review of program
16. C Curriculum/syllabus analysis

17.C Community service/volunteerism participation

18.C Other:

Does your program have an experiential learning component?  yes  no  
If yes, how do you assess the student learning outcomes from that experience?

1. Participate in a class designed to complement the experience
2. Student journals
3. Formal evaluation procedures from field-based supervisor
4. Formal meetings between supervisor, student, and faculty
5. Formal test of practical skills
6. Other:

### Implementation Plans

1. How has your department used any of the indicators above to improve services and programs for students?

The Food Science major is reviewed every five years for certification by the Institute of Food Technologists, which is the professional society of food scientists. The above indicators are used in an annual assessment of food science courses and of the overall program for continuous improvement of the curriculum.

2. When you think about developing and implementing an assessment plan, what concerns do you have?

None

**Return this form to: Kelly Funk**  
**221 Administration Building**

Assessing Student Outcomes modified and used with permission, Dr. Sharron L. Ronco, Florida Atlantic University

g. Requirements:

The Specialization in Beverage Science and Technology is designed to provide students with fundamental knowledge of the production of fermented beverages. The specialization is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University. The specialization is administered by the Department of Food Science and Human Nutrition.

With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

Requirements for the Specialization in Beverage Science and Technology

The student must complete all of the following courses: *15 credits*

- 3 { • MMG 301 Introductory Microbiology 3 credits
- OR
- 3 { • MMG 201 Fundamentals of Microbiology 3 credits
- OR
- FSC 342 Food Safety and Hazard Analysis Critical Control
- Point Program 3
- credits
- 3 { • HRT 430 Exploring Wines and Vines 3 credits
- OR
- 3 { • HB 409 Introduction to Wine 3 credits
- 3 • FSC 481-701 Fermented Beverages (Proposed new course) 3 credits
- 3 • CEM 482/ FSC 482-701 Science and Technology of Wine Production (Request for a permanent course number) 3 credits
- 3 • CHE 483/ FSC 483-701 Brewing and Distilled Beverage Technology (Request for a permanent course number) 3 credits

h. The courses FSC 481, CEM 482, and CHE 483 will be taught off campus to conform with the university ordinance prohibiting courses on campus in which students may consume alcohol. The locations will be local licensed facilities, e.g. Uncle John's Fruithouse Winery, Burgdorf's Winery.

- i. N/A
- j. N/A

**16. Are there admissions requirements for this program?:**

Grade or grade-point average requirements and if so in which course(s), portfolio requirement, audition, essay, etc. If there are not admission requirements other than those required by the University policy indicate "none".

None

**DEPARTMENT LEVEL APPROVAL STATUS**



Approved: Department of Food Science and Human Nutrition  
10/12/2012 10:22:56 AM by Debbie Klein for Frederik Derksen, Chairperson

#### **SIGNOFFS STATUS**

Signed Off: Department of Horticulture  
10/15/2012 11:05:33 AM by Susan Gruber for William V. Baird, Chairperson

Signed Off: School of Hospitality Business  
10/15/2012 8:51:06 AM by Ronald Cichy for Ronald F. Cichy, Director

Comments: would like the option of Hospitality Business majors earning the specialization, if they have completed the prerequisites, and the required courses

Signed Off: Eli Broad College of Business and The Eli Broad Graduate School of Management  
10/16/2012 12:17:48 PM by Michelle McNure for John A. Wagner III, Associate Dean

Comments: See comment from Hospitality Business.

#### **COLLEGE LEVEL APPROVAL STATUS**

Approved: College of Agriculture and Natural Resources  
10/16/2012 1:33:03 PM by Richard Brandenburg for Richard Brandenburg, Associate Dean

Approved: College of Natural Science  
10/12/2012 11:27:59 AM by Teri Roache for Kathryn M. Doig, Associate Dean

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# DEPARTMENT of FOOD SCIENCE and HUMAN NUTRITION

## *Frederik Derksen, Chairperson*

The Department of Food Science and Human Nutrition is administered jointly by the College of Agriculture and Natural Resources and the College of Natural Science. The mission of the department of Food Science and Human Nutrition is to advance human health through excellent teaching, research, and outreach programs in the disciplines of food science and human nutrition. Our faculty address contemporary issues related to global food safety, quality, food product development, and production as well as nutrition in the context of human health, chronic disease prevention, and food security.

## UNDERGRADUATE PROGRAMS

The department offers Bachelor of Science degree programs with majors in dietetics, food science, and nutritional sciences. A Minor in Nutritional Sciences ~~and a Specialization in Food Processing and Technology are also available.~~

Students who are enrolled in the Bachelor of Science degree program with a major in food science may elect a Specialization in Agricultural and Natural Resources Biotechnology. For additional information, refer to the *Specialization in Agricultural and Natural Resources Biotechnology* statement.

*and a Specialization in Beverage  
Science and Technology*

## DIETETICS

The undergraduate program in dietetics has been approved by the American Dietetic Association (ADA) as a Didactic Program that meets the minimum academic requirements for professionally qualified dietitians.

The undergraduate program in dietetics is designed so that supporting disciplines provide a knowledge base prerequisite to the professional courses. Course offerings are sequenced to build upon previous knowledge and provide increasingly complex experiences. The student is expected to acquire approximately equal expertise in nutritional assessment and care and in foodservice management systems.

Verification of successful completion of the ADA approved minimum academic requirements is the responsibility of the Dietetic Program Director in the Department of Food Science and Human Nutrition.

Persons who wish to receive a final Verification Statement for the fulfillment of ADA approved minimum academic requirements from Michigan State University, but who have not completed a Bachelor of Science degree with a Dietetics major at Michigan State University, must complete a minimum of 10 credits in 300–400 level courses in dietetics at Michigan State University with a minimum grade of 2.0 or better in each course.

Eligibility for the Registration Examination for Dietitians is determined by verification of successful completion of an Approved ADA Didactic Program in Dietetics and one of the following supervised practice experiences: ADA Accredited Dietetic Internship, ADA Accredited Coordinated Program, or ADA Approved Preprofessional Practice Program. Dietetic registration, as administered by the Commission on Dietetic Registration, is a requirement of most positions for professional dietitians.

**Admission as a Junior**

Enrollment in the dietetics major is limited. The Bachelor of Science Degree in Dietetics is a professional degree, which requires acceptance into a competitive internship in order to complete the requirements for eligibility to take the registered dietitian examination. A minimum cumulative grade-point average of 2.5 is necessary to be considered for admission.

**Requirements for the Bachelor of Science Degree in Dietetics**

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog.

The University's Tier II writing requirement for the Dietetics major is met by completing Human Nutrition and Foods 300, 471 and 472. Those courses are referenced in item 3. a. below.

Students who are enrolled in the Dietetics major leading to the Bachelor of Science degree in the Department of Food Science and Human Nutrition may complete an alternative track to Integrative Studies in Biological and Physical Sciences that consists of the following courses: Biochemistry 200 or Physiology 250; Chemistry 141, 143, and 161. The completion of Chemistry 143 and 161 satisfies the laboratory requirement.

2. The requirements of the College of Agriculture and Natural Resources for Bachelor of Science and Bachelor of Arts degrees.
3. The following requirements for the major:

	CREDITS
a. All of the following courses in the Department of Food Science and Human Nutrition:	44
HNF 150 Introduction to Human Nutrition	3
HNF 300 Experimental Approaches to Foods	4
HNF 320 Basic Skills in Dietetic Practice	3
HNF 377 Applied Community Nutrition	4
HNF 400 Art and Science of Food Preparation	2
HNF 406 Sociocultural Aspects of Food	3
HNF 440 Foodservice Operations	3
HNF 444 Management of Food and Nutrition Services	3
HNF 445 Foodservice Management Experience	2
HNF 453 Nutrition and Human Development	3
HNF 461 Advanced Human Nutrition: Carbohydrates, Lipids and Proteins	3
HNF 462 Advanced Human Nutrition: Vitamins and Minerals	3
HNF 471 Medical Nutrition Therapy I	4
HNF 472 Medical Nutrition Therapy II	4
b. The following courses outside the Department of Food Science and Human Nutrition:	39 to 42
(1) All of the following courses (30 credits):	
ANTR 350 Human Gross Anatomy and Structural Biology	3
BMB 200 Introduction to Biochemistry	4
CEM 141 General Chemistry	4
CEM 143 Survey of Organic Chemistry	4
CEM 161 Chemistry Laboratory I	1
FSC 342 Food Safety and Hazard Analysis Critical Control Point Program	3
MGT 325 Management Skills and Processes	3
PSL 250 Introductory Physiology	4
PSY 101 Introductory Psychology	4
(2) One of the following courses (3 or 5 credits):	
MTH 103 College Algebra	3
MTH 116 College Algebra and Trigonometry	5
(3) One of the following courses (3 or 4 credits):	
STT 200 Statistical Methods	3
STT 201 Statistical Methods	4
(4) The following course (3 credits):	
CSE 101 Computing Concepts and Competencies	3
Students who pass a waiver examination will not be required to complete Computer Science and Engineering 101.	

**FOOD SCIENCE**

Graduates with a Bachelor of Science degree in food science may be employed by food and allied industries, federal and state governments, and universities to work at the interface between the production and delivery of food. The program also prepares students for advanced study in graduate and professional schools. The required courses stress the principles of food safety and preservation and the application of scientific principles to control and enhance the flavor, color, texture, and nutritive value.

In addition to the core program, students in food science must complete one of the following interdisciplinary concentrations that are designed to provide additional breadth and depth: basic food science, food business and industry, food packaging, or food technology.

**Basic Food Science.** This concentration is designed for students with an interest in integrating in-depth study of basic sciences with the core of their food science education. Advanced courses in chemistry, microbiology, food safety, toxicology and pharmacology are among the fields students may elect to strengthen their bachelor's degree. Students interested in professional post-graduate education such as medicine and dentistry may elect to take a series of courses that meets the admission standards for most professional colleges.

**Food Business and Industry.** This concentration is designed for students who are interested in working for food or food-related businesses, where a knowledge of both food science and of food business management, economics, and marketing is important. Students who complete this concentration may pursue careers in manufacturing management, technical sales, food product marketing, or similar areas or may pursue graduate study in business.

**Food Packaging.** This concentration is designed to prepare students for careers in the food industry with an emphasis in food packaging. The concentration focuses on the design, use, and evaluation of food packaging materials and the effect of packaging materials on the shelf life of food. Students who complete this concentration may pursue graduate study in packaging or food science.

**Food Technology.** This concentration focuses on food processing methods and their effect on food quality and process characteristics. Students who complete this concentration may pursue careers in production supervision, quality assurance, inspection, product development, and process development. They may also pursue graduate study to prepare for positions in research, production, and management in the food industry, government, or universities.

### Requirements for the Bachelor of Science Degree in Food Science

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Food Science.

The University's Tier II writing requirement for the Food Science major is met by completing all of the following courses: Food Science 325, 402, 440, 441, 455, 470. Those courses are referenced in item 3.a. below.

Students who are enrolled in the Food Science major leading to the Bachelor of Science degree in the Department of Food Science and Human Nutrition may complete an alternative track to Integrative Studies in Biological and Physical Sciences that consists of the following courses: Biological Science 161, Chemistry 161 and 162, and Physics 231. The completion of Chemistry 161 and 162 satisfies the laboratory requirement. Biological Science 161, Chemistry 161 and 162 and Physics 231 may be counted toward both the alternative track and the requirements for the major referenced in item 3. below.

The completion of the College of Agriculture and Natural Resources mathematics requirement may also satisfy the University mathematics requirement.

2. The requirements of the College of Agriculture and Natural Resources for the Bachelor of Science degree.

Certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate. The completion of Mathematics 124 satisfies the College's mathematics requirement.

3. The following requirements for the major:

		CREDITS
a.	All of the following courses:	51
	BE 429 Fundamentals of Food Engineering	3
	BS 161 Cell and Molecular Biology	3
	CEM 141 General Chemistry	4
	CEM 142 General and Inorganic Chemistry	3
	CEM 161 Chemistry Laboratory I	1
	CEM 162 Chemistry Laboratory II	1
	FSC 211 Principles of Food Science	3
	FSC 325 Food Processing: Unit Operations	3
	FSC 401 Food Chemistry	3
	FSC 402 Food Chemistry Laboratory	1
	FSC 410 Sensory Analysis and Consumer Research	3
	FSC 440 Food Microbiology	3
	FSC 441 Food Microbiology Laboratory	2
	FSC 455 Food and Nutrition Laboratory	3
	FSC 470 Integrated Approaches to Food Product Development	3
	HNF 260 Principles of Human Nutrition	3
	MMG 301 Introductory Microbiology	3
	MTH 124 Survey of Calculus I	3
	PHY 231 Introductory Physics I	3
b.	Two of the following courses (6 credits):	

- FSC 430 Food Processing: Fruits and Vegetables ..... 3
- FSC 431 Food Processing: Cereals ..... 3
- FSC 432 Food Processing: Dairy Foods ..... 3
- FSC 433 Food Processing: Muscle Foods ..... 3
- c. One of the following courses (3 credits):
- ACR 205 Agriculture and Natural Resources Communication  
 Theory and Practice ..... 3
- COM 100 Human Communication ..... 3
- COM 225 Introduction to Interpersonal Communication ..... 3
- d. One of the following concentrations: ..... 23 to 26

**Basic Food Science (25 credits):**

- (1) All of the following courses (16 credits):
- BMB 401 Comprehensive Biochemistry ..... 4
- CEM 251 Organic Chemistry I ..... 3
- CEM 252 Organic Chemistry II ..... 3
- CEM 255 Organic Chemistry Laboratory ..... 2
- STT 201 Statistical Methods ..... 4
- (2) Nine credits from the following courses (9 credits):
- ANS 407 Food and Animal Toxicology ..... 3
- ANS 417 Topics in Toxicology ..... 1
- CEM 262 Quantitative Analysis ..... 3
- CEM 333 Instrumental Methods and Applications ..... 3
- CEM 383 Introductory Physical Chemistry I ..... 3
- FSC 342 Food Safety and Hazard Analysis Critical  
 Control Point Program ..... 3
- FSC 421 Food Laws and Regulations ..... 3
- MMG 409 Eukaryotic Cell Biology ..... 3
- MMG 425 Microbial Ecology ..... 3
- MMG 431 Microbial Genetics ..... 3
- MMG 445 Microbial Biotechnology (W) ..... 3
- MMG 451 Immunology ..... 3
- PHM 350 Introductory Human Pharmacology ..... 3
- PHM 450 Introduction to Chemical Toxicology ..... 3

The Basic Food Science concentration fills many, but not all, of the minimum requirements for admission to professional schools. Students interested in preparing for post-graduate professional programs should consult with a preprofessional advisor in the College of Natural Science. Admission requirements of professional schools vary and the student is responsible for reviewing the requirements of each school of interest and consulting regularly with an advisor.

**Food Business and Industry (23 credits):**

- (1) All of the following courses (17 credits):
- ACC 230 Survey of Accounting Concepts ..... 3
- BMB 200 Introduction to Biochemistry ..... 4
- CEM 143 Survey of Organic Chemistry ..... 4
- MKT 327 Introduction to Marketing ..... 3
- STT 315 Introduction to Probability and  
 Statistics for Business ..... 3
- (2) Two of the following courses (6 credits):
- ABM 100 Decision-making in the Agri-Food System ..... 3
- ABM 222 Agribusiness and Food Industry Sales (W) ..... 3
- ABM 435 Financial Management in the Agri-Food  
 System ..... 3
- FI 311 Financial Management ..... 3
- FIM 335 Food Marketing Management ..... 3
- MKT 302 Consumer and Organizational Buyer  
 Behavior ..... 3

Either Finance 311 or Agribusiness Management 435, but not both of those courses, may be used to satisfy requirement (2) for the **Food Business and Industry** concentration.

**Food Packaging (26 credits):**

- (1) All of the following courses:
- BMB 200 Introduction to Biochemistry ..... 4
- CEM 143 Survey of Organic Chemistry ..... 4
- PKG 101 Principles of Packaging ..... 3
- PKG 221 Packaging with Glass and Metal ..... 3
- PKG 322 Packaging with Paper and Paperboard ..... 4
- PKG 323 Packaging with Plastics ..... 4
- STT 201 Statistical Methods ..... 4

**Food Technology (23 credits):**

- (1) All of the following courses (14 credits):
- BMB 200 Introduction to Biochemistry ..... 4
- CEM 143 Survey of Organic Chemistry ..... 4
- FSC 420 Quality Assurance ..... 2
- STT 201 Statistical Methods ..... 4
- (2) Nine credits from the following courses (9 credits):
- FSC 430 Food Processing: Fruits and Vegetables ..... 3
- FSC 431 Food Processing: Cereals ..... 3
- FSC 432 Food Processing: Dairy Foods ..... 3
- FSC 342 Food Safety and Hazard Analysis Critical  
 Control Point Program ..... 3
- FSC 421 Food Laws and Regulations ..... 3
- FSC 433 Food Processing: Muscle Foods ..... 3
- HB 100 Introduction to Hospitality Business ..... 2
- HB 265 Food Management: Safety and Nutrition ..... 3
- HB 267 Management of Food and Beverage Systems ..... 3
- HNF 300 Experimental Approaches to Food ..... 4

Courses selected to meet this requirement may not be used to fulfill requirement 3. b. above.

## NUTRITIONAL SCIENCES

The nutritional sciences major emphasizes intensive study in biological and physical sciences as a basis for understanding the science of nutrition and the relationships between nutrients and human health. Core course requirements emphasize human nutrition with areas of study in energy metabolism, proteins, vitamins, minerals, and nutrition in the prevention and treatment of disease. Issues and techniques involved in nutrition research, and a food and nutrition laboratory course are included in the core courses. Supporting discipline courses emphasize biochemistry, biology, chemistry, mathematics, microbiology, physics and physiology.

This major is designed to meet the admissions requirements of most colleges of medicine, dentistry and paramedical colleges while the student pursues a bachelors degree in a clinically related area. The major also prepares students to enter graduate school programs in nutrition and other life sciences. Graduates in nutritional sciences qualify for positions in the food industry, corporate wellness and health promotion programs, public health programs, pharmaceutical sales and similar occupations.

### Requirements for the Bachelor of Science Degree in Nutritional Sciences

- The University requirements for bachelor's degrees as described in the Undergraduate Education section of this catalog.

The University's Tier II writing requirement for the Nutritional Sciences major is met by completing Food Science 455 and Human Nutrition and Foods 464. Those courses are referenced in Item 3. a. below.

Students who are enrolled in the Nutritional Sciences major leading to the Bachelor of Science degree in the Department of Food Science and Human Nutrition may complete an alternative track to Integrative Studies in Biological and Physical Sciences that consists of the following courses: Chemistry 141, 161, 162; Physiology 431. The completion of Chemistry 161 and 162 satisfies the laboratory requirement.

- The requirements of the College of Agriculture and Natural Resources for the Bachelor of Science degree.

The credits earned in certain courses referenced in item 3. below may be counted toward college requirements as appropriate.

The completion of Mathematics 124 or 132 satisfies the college mathematics requirement.

- The following requirements for the major:

	CREDITS
a. The following courses in the Department of Food Science and Human Nutrition: .....	21 to 23
(1) All of the following courses (19 credits):	
FSC 211 Principles of Food Science .....	3
FSC 455 Food and Nutrition Laboratory .....	3
HNF 260 Principles of Human Nutrition .....	3
HNF 461 Advanced Human Nutrition: Carbohydrates, Lipids and Proteins .....	3
HNF 462 Advanced Human Nutrition: Vitamins and Minerals .....	3
HNF 464 Nutrition in the Prevention and Treatment of Disease .....	4
(2) One of the following courses (2 to 4 credits):	
HNF 375 Community Nutrition .....	2
HNF 406 Sociocultural Aspects of Food .....	3
HNF 471 Medical Nutrition Therapy I .....	4
b. The following courses outside the Department of Food Science and Human Nutrition: .....	59 to 64
(1) One of the following options (4 or 6 credits):	
(a) BMB 401 Comprehensive Biochemistry .....	4
(b) BMB 461 Advanced Biochemistry I .....	3
BMB 462 Advanced Biochemistry II .....	3
(2) All of the following courses (31 credits):	
BS 161 Cell and Molecular Biology .....	3
BS 171 Cell and Molecular Biology Laboratory .....	2
CEM 251 Organic Chemistry I .....	3
CEM 252 Organic Chemistry II .....	3
CEM 255 Organic Chemistry Laboratory .....	2
MMG 301 Introductory Microbiology .....	3
MMG 302 Introductory Laboratory for General and Allied Health Microbiology .....	1
PHY 231 Introductory Physics I .....	3
PHY 232 Introductory Physics II .....	3
PHY 251 Introductory Physics Laboratory I .....	1
PHY 252 Introductory Physics Laboratory II .....	1
PSL 431 Human Physiology I .....	3
PSL 432 Human Physiology II .....	3
(3) One of the following options (6 or 7 credits):	
(a) The following course:	
MTH 124 Survey of Calculus I .....	3

- One of the following courses:
- |         |                           |   |
|---------|---------------------------|---|
| MTH 126 | Survey of Calculus II     | 3 |
| STT 201 | Statistical Methods       | 4 |
| STT 231 | Statistics for Scientists | 3 |
| STT 421 | Statistics I              | 3 |
- (b) The following course:
- |         |            |   |
|---------|------------|---|
| MTH 132 | Calculus I | 3 |
|---------|------------|---|
- One of the following courses:
- |         |                           |   |
|---------|---------------------------|---|
| MTH 133 | Calculus II               | 4 |
| STT 201 | Statistical Methods       | 4 |
| STT 231 | Statistics for Scientists | 3 |
| STT 421 | Statistics I              | 3 |
- (4) One course from each of the following groups (9 to 12 credits):
- (a)
- |          |                                   |   |
|----------|-----------------------------------|---|
| CEM 141  | General Chemistry                 | 4 |
| CEM 151  | General and Descriptive Chemistry | 4 |
| CEM 181H | Honors Chemistry I                | 4 |
- (b)
- |          |                                 |   |
|----------|---------------------------------|---|
| CEM 142  | General and Inorganic Chemistry | 3 |
| CEM 152  | Principles of Chemistry         | 3 |
| CEM 182H | Honors Chemistry II             | 4 |
- (c)
- |          |                               |   |
|----------|-------------------------------|---|
| CEM 161  | Chemistry Laboratory I        | 1 |
| CEM 165H | Honors Chemistry Laboratory I | 2 |
- (d)
- |          |                                |   |
|----------|--------------------------------|---|
| CEM 162  | Chemistry Laboratory II        | 1 |
| CEM 186H | Honors Chemistry Laboratory II | 2 |
- (5) One of the following courses (3 or 4 credits):
- |          |  |   |
|----------|--|---|
| ANTR 350 | Human Gross Anatomy and Structural Biology | 3 |
| CEM 262  | Quantitative Analysis                      | 3 |
| MMG 409  | Eukaryotic Cell Biology                    | 3 |
| PHM 350  | Introductory Human Pharmacology            | 3 |
| ZOL 341  | Fundamental Genetics                       | 4 |
| ZOL 408  | Histology                                  | 4 |

### MINOR IN NUTRITIONAL SCIENCES

The Minor in Nutritional Sciences, which is administered by the Department of Food Science and Human Nutrition, will broaden students' understanding of the science of nutrition and the relationships between food and health.

The minor is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University other than the Bachelor of Sciences Degree in Nutritional Sciences or the Bachelor of Science Degree in Dietetics. With the approval of the department and college that administers the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree.

Students who plan to complete the requirements for the minor should consult a Nutritional Sciences undergraduate advisor in Department of Food Science and Human Nutrition.

### Requirements for the Minor in Nutritional Sciences

	CREDITS
Complete a 15 credits from the following:	
1. One of the following courses (3 credits):	
HNF 150 Introduction to Human Nutrition	3
HNF 260 Principles of Human Nutrition	3
2. All of the following courses (12 credits):	
HNF 375 Community Nutrition	2
HNF 461 Advanced Human Nutrition: Carbohydrates, Lipids and Proteins	3
HNF 462 Advanced Human Nutrition: Vitamins and Minerals	3
HNF 464 Nutrition in the Prevention and Treatment of Disease	4

Insert ①

### SPECIALIZATION IN FOOD PROCESSING AND TECHNOLOGY

The Specialization in Food Processing and Technology is available as an elective to students who are enrolled in bachelor's degree programs in the College of Agriculture and Natural Resources (other than the Bachelor of Science degree program with a major in food science), The School of Hospitality Business, the Department of Food Science and Human Nutrition in the College of Human Ecology, and the Department of Microbiology and Molecular Genetics and to students who are enrolled in the Environmental Biology/Microbiology and Microbiology coordinate majors in Lyman Briggs School. The Department of Food Science and Human Nutrition administers the specialization.

**SPECIALIZATION IN BEVERAGE SCIENCE AND TECHNOLOGY**

The Specialization in Beverage Science and Technology is designed to provide students with fundamental knowledge of the production of fermented beverages. Certain courses in this specialization are only offered at off-campus wineries or breweries. The specialization is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University. The specialization is administered by the Department of Food Science and Human Nutrition.

With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

**Requirements for the Specialization in Beverage Science and Technology**

			CREDITS
Students must complete 15 credits from the following:			
1.	One of the following courses (3 credits):		
	FSC	342	Food Safety and Hazard Analysis Critical Control Point Program
			3
	MMG	201	Fundamentals of Microbiology
			3
	MMG	301	Introductory Microbiology
			3
2.	One of the following courses (3 credits):		
	HB	409	Introduction to Wine
			3
	HRT	430	Exploring Wines and Vines
			3
3.	All of the following courses (9 credits):		
	CEM	482	Science and Technology of Wine Production
			3
	CHE	483	Brewing and Distilled Beverage Technology
			3
	FSC	481	Fermented Beverages
			3



The primary educational objective of the specialization is to provide students with basic knowledge of food processing. The undergraduate coordinator for food science in the Department of Food Science and Human Nutrition is available to assist students in planning their programs of study for the specialization.

With the approval of the college and department that administer the student's degree program, the courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

**Requirements for the Specialization in Food Processing and Technology**

The student must complete:

	CREDITS
1. One of the following courses: . . . . .	3 or 4
ANS 210 Animal Products . . . . .	4
FSC 211 Principles of Food Science . . . . .	3
2. The following course: . . . . .	4
FSC 325 Food Processing: Unit Operations . . . . .	4
3. Two of the following courses: . . . . .	5 or 6
FSC 342 Food Safety and Hazard Analysis Critical Control Point Program . . . . .	3
FSC 420 Quality Assurance . . . . .	2
FSC 421 Food Laws and Regulations . . . . .	3
4. One of the following courses: . . . . .	3
ANS 320 Muscle Foods . . . . .	3
FSC 430 Food Processing: Fruits and Vegetables . . . . .	3
FSC 431 Food Processing: Cereals . . . . .	3
FSC 432 Food Processing: Dairy Foods . . . . .	3
FSC 433 Food Processing: Muscle Foods . . . . .	3