Fermentation Science (Major, Courses)

Fermentation Science will prepare students for careers in fermentation-related industries and will provide graduates with the requisite background to pursue advanced studies in fermentation-related fields, including but not limited to brewing, distilling, and enology. The program provides interdisciplinary training drawing from departments in various colleges and the Fermentation Science Institute. Fermentation science involves basic and applied science in several core scientific areas, including microbiology, plant biology, food science and chemistry, as well as the more applied areas of the agricultural sciences.

Bachelor of Science Degree in Fermentation Science

Required Courses:

University Core Curriculum (39)[1]
Total Credit Hours (120)
1. A total of 15 credit hours of major courses count toward the core

Major Requirements (86)

Fermentation Science (26)
- Required (18)
- FERM 100 Principles of Fermentation Science (3)
- FERM 101 Fermentation Science Laboratory (1)
- HND 356 Experimental Foods (3)
- FERM 390 Fermentation Research (1)
- FERM 460 Sensory Analysis (4)
- FERM 462 Yeast Science and Technology (4)
- FERM 491 Fermentation Internship (1)
- Choose 9 hours minimum (9)
- CHEM 180 The Chemistry of Beer and Brewing (2)
- CHEM 181 Chemistry of Beer and Brewing Lab (1)
- HORT 333 From the Vine to its Wine (3)
- HORT 466 Vine and Small Fruit Culture (4)
- FERM 480 Advanced Brewing Science and Analysis (4)
- FERM 489 (AGSE 489) Brewing and Distilling Technology (3)

Science (56)
- Biology (12)
- BIOL 200A Cell and Introductory Biology, Genetics and Evolution (4)
- BIOL 200B Introductory Organismal Biology and Ecology (4)
- MICR 301, Principles of Microbiology (4)
- Chemistry (25)
- CHEM 200 Introduction to Chemical Principles (3)
- CHEM 201 General Chemistry Laboratory I (1)
- CHEM 202 Introductory Chemistry Workshop (1)
- CHEM 210 General and Inorganic Chemistry (3)
- CHEM 211 General Chemistry Laboratory II (1)
- CHEM 212 General Chemistry Workshop (1)
- CHEM 330 Quantitative Analysis (5)

CHEM 339Introduction to Organic Chemistry (3)
CHEM 341 Organic Chemistry Laboratory I (2)
CHEM 350 Introduction to Biological Chemistry (3)
CHEM 351 Biochemistry Laboratory (2)
Physics (8)
PHYS 203A College Physics (3)
PHYS 253A College Physics Laboratory (1)
PHYS 203B College Physics (3)
PHYS 253B College Physics Laboratory (1)
Mathematics and Statistics (7)
MATH 150 Calculus I (4)
MATH 282 Introduction to Statistics (3)

Hospitality and Business-Choose 2 (4 hours minimum)
HTA 202 Introduction to Hospitality and Tourism (3)
HTA 335 Beverage Management (3)
HTA 206 Food Service Sanitation (1)
ECON 240 Microeconomics (3)
MGMT 350 Small Business Management (3)

Fermentation Science Suggested Curricular Guide

Year 1

Fall	**Credits**	**Spring**	**Credits**
UCOL 101	1	HTA 202	3
CI199	1	BIOL 200B	4
BIOL 200A	4	FERM 100, 101	4
CHEM 200, 201, 202	5	CHEM 210, 211, 212	5
MATH 150	4		
TOTAL	**15**		**16**

Year 2

Fall	**Credits**	**Spring**	**Credits**
ENGL 101	3	HND 356	3
MATH 282	3	MICR 301	4
CHEM 339, 341	5	UCC Fine Arts	3
CHEM 330	5	ENGL 102	3
		FERM 390	1
TOTAL	**16**		**14**

Year 3

Fall	**Credits**	**Spring**	**Credits**
FERM 480	4	CHEM 350, 351	5
HTA 206	1	CHEM 180	2
PHYS 203A, 253A	4	PHYS 203B, 253B	4
HORT 466	3	UCC Humanities	3
PHIL 105	3	CMST 101	3
TOTAL	**15**		**17**

Year 4

Fall	Credits	Spring	Credits
HORT 333	3	FERM 460	4
FERM 489	3	CHEM 181	1
HTA 335	3	UCC Multicultural	3
ECON 240	3	FERM 462	4
FERM 390	1	FERM 390	1
		FERM 491	1
TOTAL	**13**		**14**

Required Courses (FERM)

FERM 100-3 Principles of Fermentation Science
A survey course that covers the scientific, technological, and cultural aspects of fermentation. The course will survey various aspects of fermentation, ranging from historical and cultural implication of fermentation as a method to process and preserve food to the modern manufacture of alcoholic beverages, foods, pharmaceuticals, and the production of energy. The process of fermentation will be discussed from basic microbiological and biochemical perspectives, with an emphasis on understanding the physical and chemical changes that occur during the fermentation process. Fermentation topics that will be discussed include alcoholic beverages, food preservation and production, and energy production. *Prerequisite: CHEM 200 and BIOL 200A, or equivalent.*

FERM 101-1 Fermentation Science Laboratory
The laboratory complement to FERM 100, Principles of Fermentation Science. The laboratory will cover various aspects of fermentation in a hands-on experiential environment with an emphasis on the basic microbiological and biochemical chemical changes that occur during the fermentation process. Lab fee: $60. *Corequisite:* FERM 100.

FERM 390-1-2 Fermentation Research
Research under the direction and supervision of a faculty advisor culminating in a written report. Special approval needed from the instructor.

FERM 491-1 Fermentation Internship
Internship opportunity with a fermentation related business.

FERM 460-4 Sensory Analysis
The course covers the science of the human senses as applied to alcoholic beverages. The physiological and neurological basis of human sensing are covered from the perspective of detecting and identifying both desirable traits and perceived flaws in products. The concepts of experimental design and statistical analysis are covered, as well as practical aspects of designing and maintaining sensory panels. Three hours lecture and three hours laboratory per week. *Prerequisite:* CHEM 181 or HORT 333 or consent of instructor. Lab Fee: $45. Age Restricted: Students must be 21 years of age prior to first lab meeting.

FERM 462-4 Yeast Science and Technology
An in-depth look at yeast from the perspective of fermentation science, with an emphasis on brewing science and enology. The effects of genetics will be examined with respect to how various strains and genetic mutations affect the fermentation process and the quality of the final product. The course will emphasize yeast metabolism and the various parameters and conditions that affect fermentation processes. The techniques dealing with yeast collection, storage and culturing will be covered from both theoretical

and practical perspectives. Lectures will be supplemented with hands-on laboratory experiments. Two hours lecture and 6 hours laboratory per week. *Prerequisite:* MICR 301 or consent of instructor. Lab Fee: $60.

FERM 480-4 Advanced Brewing Science and Analysis
An advanced coverage of concepts in brewing, providing in-depth coverage of beer, brewing and quality control processes. Students will gain an understanding of the raw materials used in the production of beer. Specific coverage will be given to the processing and effects of raw materials, technical and scientific aspects of the brewing process, and the various processes that occur during fermentation, conditioning and packaging. In addition, the concept of beer quality and methods of ensuring quality control will be covered in detail, including the various methods of analysis that are used in the brewing industry. Two hours lecture and 6 hours laboratory per week. *Prerequisite:* CHEM 180/181, FERM 100 and CHEM 230 or consent of instructor. Lab Fee: $60. Age Restricted: Students must me 21 years of age prior to the first class meeting.

FERM 489-3 (AGSE 489) Brewing and Distilling Technology
The primary focus on this course is to introduce the basic facilities planning for the operation of the brewing and distilling industry, and to gain management and technology insight in brewing/distilling production. Restricted to Junior/Senior standing in Ag Systems Technology or AGSE 375, basic email computer skills. Special approval needed from the instructor.

Required Courses (Other)

HND 256-3 Science of Food
Application of scientific principles including preparation, chemistry, functions, and interrelationships in ingredients and their effects on physical, chemical, and sensory characteristics of foods. Three lectures and two three hour laboratories per week. *Prerequisite:* CHEM 140A or 200 and 201.

CHEM 180-2 The Chemistry of Beer and Brewing
The course covers the science and chemistry of beer and brewing. The history of beer and brewing will be introduced to follow the evolution of beer as a food and beverage, including how beer has impacted society and how brewing has been affected by society. The chemistry of the four basic ingredients of beer (water, malt, hops, and yeast) will be explored, as well as the chemistry of the brewing process. The various styles of beer will be introduced and discussed with respect to how the styles can be achieved based on the chemistry of the ingredients and process. Home brewing and commercial brewing will be compared. The course does not presume a background in chemistry and various chemical concepts will be introduced on an as needed basis.

CHEM 181-1 Chemistry of Beer and Brewing Lab
The laboratory complement to CHEM 180, The Chemistry of Beer and Brewing. The laboratory will cover various aspects of beer and brewing in a hands-on experiential environment. A major component will be guided tasting sessions of the various style categories of beer. Students will participate in brewing beer from base ingredients using various brewing techniques. Experiments conveying basic biology, chemistry and physical science concepts will be conducted. In addition, spectroscopic and chromatographic methods will be used to analyze flavor and ingredient components in beer. Special tours may also be arranged in regional breweries and hop yards. Students must be of legal drinking age prior to the first laboratory meeting. Special approval needed from the instructor. Lab fee: $90. *Prerequisite:* HORT 333, HORT 466, BIOL 200A.

HORT 333-3 From the Vine to its Wine
Introduction to grape growing and the making, using and appreciation of wine for pleasure, health and profit. Discover the science and art of growing, making and using wine. Participatory approach to instruction with emphasis on beginning the novice on a successful journey through the wonderful world of grapes and wine. Includes a Midwest perspective. A three-day tour of the regional industry and a Saturday tour of local establishments required. Must be 21 years of age by September 15 (prior to wine tasting exercises) of semester taken to enroll. Proof of age and signature on informed consent form required at first class meeting. Offered fall semester only. Purchase and use of required textbook mandatory. Lab fee: $245.

HORT 466-4 (PSAS 466) Vine and Small Fruit Culture
Study of the developmental patterns and environmental responses of important vine and small fruit crops; strawberries, brambles, blueberries, grapes and exotic crops. Learn to adapt these crops to profitable culture for the amateur or professional with a Midwest focus. Practical hands-on experience in the classroom and the field. Two one-day field trips required. Required textbooks mandatory. Not for graduate credit. Special approval needed from the department. Lab fee: $150.