Brewing and Fermentation Science Short Course

The Brewing and Fermentation Science short course is a 3-day program held January 8th, 9th, and 10th 2024 in which hobbyists, professional brewers, and other participants will have the opportunity to learn and experience the fundamentals in brewing science, brewing technology, safety, and sensory analysis. Participants will gain valuable industry insight from the professionals at Manhattan Brewing Company, as well as instruction from faculty at Kansas State University and other industry professionals on the brewing process and the science behind it. The short course will be held at Manhattan Brewing Company’s Taproom and Brewery in Manhattan, Kansas where participants can get a hands-on experience and apply what they learn. The curriculum will touch base on all facets of the brewing process including, raw ingredients, brewing technology and techniques, fermentation, safety, packaging, and tasting of the finished product. This short course covers basics in brewing, cellaring, packaging, raw ingredients, safety practices, beer styles, and sensory analysis. 21+ to enroll.

You can expect to learn about:
- Malt, Hops, Yeast and Water
- Mashing, Vorlaufing, Lautering, Boiling, Whirlpool, Knockout
- Fermentation
- Packaging
- Safety
- Tasting Technique
- Beer Styles
- Common Off-flavors

This short course will:
- Introduce participants to the brewing process
- Demonstrate how scientific concepts presented by Kansas State University faculty apply to brewing practices
- Offer an opportunity to be instructed by industry professionals at Manhattan Brewing Company
- Introduce sensory analysis techniques

By the end of this short course, you will be able to:
- Identify common brewing equipment
- Explain common brewing techniques
- Differentiate between Lagers and Ales
- Identify and describe a limited selection of beer styles
- Conduct simple tasting analysis of select beer styles
Agenda  *(DRAFT agenda subject to change)*

Day 1 – January 8, 2024

8:30am-8:45am *Introductions & Course Overview*, Manhattan Brewing Co. instructors
- Introductions
- Purpose & goals for the class

8:45am-9:45am *Process Overview*, Manhattan Brewing Co. instructors
1) Raw ingredient overview
2) Basic brewing ingredients
   i) Hops, Malt, Water, & Yeast
   b) Adjuncts
      i) Oats, corn, rice, etc.
3) Hot side process
   a) Mashing
   b) Lautering
   c) Boiling
   d) Whirlpool
   e) Knockout
4) Cold side process
   a) Fermentation
   b) Cellaring
   c) Packaging

9:45am-10:45am *Malt & Adjuncts*, Manhattan Brewing Co. instructors
5) Morphology
6) Variations
7) Contribution to finished product

10:45am-11:00am Break

11:00am-12:00pm *Hops*, industry expert instructor
8) Morphology
9) Variations
10) Contribution to finished product

12:00pm-12:50pm Lunch with industry expert

1:00pm-2:00pm *Yeast*, Yi Zheng, Associate Professor, Department of Grain Science and Industry
11) Morphology
12) Lager vs. Ale
   a) Ale [Saccharomyces cerevisiae]
      i) “Top fermenting” yeast
      ii) Warmer, quicker fermentation
iii) Typical fermentation by-products and beer profile
b) Lager [Saccharomyces pastorianus]
   i) “Bottom-fermenting” yeast
   ii) Cooler, longer fermentation
   iii) Typical fermentation by-products and beer profile
13) Wild “bugs”

2:00pm-3:00pm Water, Chris Culbertson, Professor, Department of Chemistry
14) Purpose
   a) Base source for solubilization
15) Makeup/Water chemistry
   a) pH
   b) Basic ions; what they do & why they are important
      i) Ca,Mg,Na,Cl,SO₄, CO₃
   c) SO₄²⁻:Cl⁻¹
   d) Water profiles from around the world

3:00pm-4:00pm History of Brewing, Kevin Roberts, Professor, Department of Hospitality Management
16) Brief history of the origins of beer and brewing

Tasting and Off-Flavor Training

4:00pm-5:00pm Introduction to Sensory Analysis, Martin Talavera, Associate Professor, Department of Food, Nutrition, Dietetics, and Health
17) Introduction to sensory analysis
   a) Sensory and consumer research applications in the industry

5:00pm-5:30pm Styles and Tasting, Manhattan Brewing Co. instructors
18) Tasting and off-flavor training
   a) Malty Beers
   b) Hoppy Beers
   c) Diacetyl (butter/butterscotch) and Acetaldehyde (green apple)
19) Styles and tasting
   a) English, Scottish, and Irish Ales
   b) American beer styles

Day 2 – January 9, 2024

8:30am-8:45am Overview of Day 2, Manhattan Brewing Co. instructors
   • Major questions & re-explanation of any concepts
   • Overview of Day 2

8:45am-9:15am Safety, Manhattan Brewing Co. instructors
1) Proper PPE
2) Chemical Safety
3) CO₂ and Confined Space
9:15am-11:00am Mashing, Manhattan Brewing Co. instructors
4) Process
   a) Milling
      i) Dry Milling vs Wet Milling
      ii) Roller Mill vs Hammer Mill
   b) Mashing
      i) Single Infusion Rest
         (1) Beta vs Alpha Amylase
      ii) Multiple Rests
         (1) Acid Rest and Modification Rest (86-126) How to Brew
            (a) Used in Pilsen to acidify mash
            (b) No longer used
      iii) Decoction Mashing
      iv) Mash Out & Vorlauf
   c) Typical water/grist ratio
      i) Thin vs Thick Mash
5) Technology
   a) Mash Tun vs Mash Press

11:00am-11:45am Lautering, Manhattan Brewing Co. instructors
6) Purpose
   a) Maximum sugar extraction
   b) Minimize Tannin Extraction
7) Technology
   a) Lauter Tun Design
   b) Lauter Tun vs Mash Press

11:45am-12:45pm Lunch

1:00pm-2:00pm Boiling, Manhattan Brewing Co. instructors
8) Purpose
   a) Sterilizing
   b) Hot break
   c) Deoxygenation
   d) Evaporation
   e) DMS Conversion and Volatilization
   f) Maillard Reactions
   g) Add Hops
      i) Boil time additions and their effects
9) Technology
   a) Fire vs Steam vs Electric

2:00pm-2:30pm Whirlpool and Knockout, Manhattan Brewing Co. instructors
10) Whirlpool
   a) Collect trub/proteins/hop material in center
b) Clear wort extraction

11) Knockout
   a) Use of heat exchanger to drop temperature
   b) Oxygenation of wort for yeast replication
   c) Cooled wort sent to sanitized vessel for yeast pitching and fermentation

12) Technology

**2:30pm-3:30pm Fermentation, K-State faculty expert**

13) What is fermentation?

14) Fermentation phases
   a) Lag phase
   b) Exponential growth phase
   c) Stationary phase
   d) Conditioning

15) Products of fermentation
   a) CO₂
   b) Ethanol
   c) Other typical by-products
      i) Esters vs phenols
      ii) Off-flavor chemicals

**3:30pm-4:00pm Content Connections & Break, Manhattan Brewing Co. instructors**
   • Q&A times

**Tasting & Off-Flavor Training**

**4:00pm-5:30pm Styles and Tasting, Manhattan Brewing Co. instructors**

16) Tasting and off-flavor training
   a) Belgian
   b) Lager and Ales
   c) Contamination
   d) H₂S

17) Styles and tasting
   a) German Beers
      i) Ales of Germany
         (1) Wheat Beers (Weissbier, Berliner Weiss)
         (2) Altbier & Kolsch
      ii) German Lagers
         (1) Bocks
         (2) Marzen & Festbier
         (3) German Pils
   b) Czech Beers
      i) Czech Premium Pale Lager (Bohemian Pils)
Day 3 – January 10, 2024

8:30am-8:45am Overview of Day 3, Manhattan Brewing Co. instructors
- Major questions & re-explanation of any concepts
- Overview of Day 3

8:45am-10:45am Cellaring and Cleaning, Manhattan Brewing Co. instructors
1) Cleaning
   a) Chemical Safety
   b) Basic chemicals
   c) Vessel Cleaning
2) Dry Hopping/Adjuncting
3) Conditioning
4) Barrel Aging
5) Transferring
6) Filtration/Centrifuging
7) Carbonation

10:45am-11:00am Break

11:00am-12:00pm Filtration, Lisa Wilken, Associate Professor, Biological and Agricultural Engineering
8) Purpose
   a) To produce clear beer
9) Technology
   a) Lenticular Filter
   b) Plate and Frame Filter
   c) Centrifuge
   d) Clarifying Chemicals
   e) Diatomaceous Earth

12:00pm-1:00pm Lunch

1:00pm-2:00pm Packaging, Manhattan Brewing Co. instructors
10) Types of packages
   a) Cans
   b) Bottles
   c) Kegs
   d) Growlers/Crowlers

2:00pm-3:00pm Draft Technology, Industry expert
11) Types of Draft systems
   a) Direct Draw
   b) Long Draw
      i) Beer Pumps
      ii) FOB Systems
Feedback Session

3:00pm-4:00pm Recap & Discussion, Manhattan Brewing Co. instructors
- Recap major points from three days
- Answer remaining questions
- Gather feedback from participants

Tasting & Off-Flavor Training

4:00pm-5:00pm Styles and Tasting, Manhattan Brewing Co. instructors

12) Off-flavor training
   a) DMS
   b) Isovaleric Acid
   c) Papery

13) Styles and tasting
   a) Belgian Beers