



in collaboration with



## Brewing and Fermentation Science Short Course

The Brewing and Fermentation Science short course is a 3-day program held January 8<sup>th</sup>, 9<sup>th</sup>, and 10<sup>th</sup> 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, SO<sub>4</sub>, CO<sub>3</sub>
  - c) SO<sub>4</sub><sup>-2</sup>:Cl<sup>-1</sup>
  - 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) CO<sub>2</sub> 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) CO<sub>2</sub>
  - 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) H<sub>2</sub>S
- 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