



## Pathway to Recognition Program

### Summary of Essential Learning Outcomes for a Two-Year AAS Degree in Brewing

A 2-year associate's in applied sciences (AAS) degree in brewing should be built on a foundation of science and demonstrated by the completion of coursework that satisfies the requirement for general sciences (e.g., math, biology, chemistry, microbiology) by the college.

A 2-year AAS-level degree in brewing should provide students with additional experience and skill sets in the science of brewing/fermentation through completion of a minimum set of capstone courses, such as those suggested below, that target the following learning outcomes and through which students can attain these learning outcomes. Hands-on experience also is recommended and could be fulfilled through internships with nearby breweries if an onsite brewing system is not available.

#### Capstone Courses

##### Suggested Capstone Courses for Brewing Science Degrees

- Brewing science
- Brewing analysis and quality assurance
- Practical malting and brewing

#### Learning Outcomes

##### Brewing Science and Brewhouse Operations

- Explain the compositional features of the four-essential brewing raw materials: malt, hops, water, and yeast
- Articulate the technological and manufacturing processes required to transform the four essential raw materials into forms suitable for brewing
- Demonstrate an ability to measure, report, and interpret the basic process analytics required in a brewing context (e.g., brewhouse performance, bitterness recovery, etc.)
- Identify the raw material composition and processing regimes required to produce various traditional styles of beers
- Explain the unit processes leading from raw materials to packaged beer
- Identify the key microbial chemical and physical threats to brewing and beer quality and determine the method of detection, prevention, and elimination from wort to packaged beer
- Summarize the basics of brewery cleaning and sanitation
- Demonstrate the ability to design and brew a beer that meets generally accepted standards

##### Sensory and Product Design

- Explain the quality attributes of beer, such as foam, stability, color, aroma, and attenuation, and interpret the reasons why a product deviates from expected performance
- Identify and describe the key contributors to beer flavor, including defects, the pathways by which they arise, and how these flavors can be controlled
- Formulate brewing recipes that reflect characteristics of primary beer styles

### **Quality Assurance and Control**

- Differentiate between the principles of QA and QC and outline the essential components of a quality system within a brewery
- Explain the relevance of key analytical parameters applied to malt, hops, water, and yeast
- Show competency in interpreting key analytical parameters for malt, adjuncts, water, hops, yeast, wort, and beer
- Explain the concept of “standard methods of analysis” and how these methods are employed from raw materials to finished beer
- Perform analytical measurements using industry-recognized standard methods and instrumentation on raw materials, in-process streams, finished products, and packaged beer for the purpose of assessing their quality

### **Best Practices**

- Demonstrate knowledge of in-line instrumentation and critical process measurement points (CPMP)
- Demonstrate knowledge of the regulatory environment with regards to overseeing breweries—food safety, brewhouse safety, environmental compliance, labeling, etc.
- Show competency in understanding the history and culture of beer (beer stewardship)
- Demonstrate knowledge of sustainability practices for raw materials, water, energy, processing, and brewery waste
- Demonstrate knowledge of social and regulatory environments regarding reasonable standards for responsible consumption