Cicerone® Certification Program
US Certified Cicerone® Syllabus

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This syllabus outlines the knowledge required of those preparing for the Certified Cicerone® exam in the United States. While this list is comprehensive in its scope of content, further study beyond the syllabus is necessary to fully understand each topic. The content tested on the Certified Cicerone exam is a subset of the information presented within the Master Cicerone® Syllabus, and individual syllabi for all four levels of the program may be found on the cicerone.org website.

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Full Syllabus

I. Keeping and Serving Beer

A. Purchasing and accepting beer
   1. The three-tier system in the United States and the reasons for its existence
      a. By law, alcoholic beverages sold in the United States must move through the three-tier system. The three tiers are Brewers/Importers, Wholesalers (also known as Distributors), and Retailers
         i. Brewers and importers sell to wholesalers
         ii. Wholesalers sell to both on- and off-premises retailers
         iii. On- and off-premises retailers sell to consumers
      b. Some states have granted exceptions to the three-tier system. Common exceptions include:
         i. Brewpubs that both brew and retail to consumers
         ii. Breweries that brew and sell directly to retailers or consumers
   2. Taxes levied on beer
      a. Specific taxes
         i. Federal Excise Tax – paid by brewers
         ii. State Excise Tax – generally processed and paid by wholesalers
         iii. Sales taxes and other locally required fees – paid by retailers
         iv. Income taxes levied on brewers, distributors, and retailers
   3. Assessing beer shipment: physical condition and age
      a. Date code if available
         i. Meaning
            • Bottling/packaging date
            • Best by date
         ii. Type: Order and number of digits may vary
            • Traditional consumer date codes (e.g., 060912 = June 9, 2012)
            • Julian/ordinal date codes (364-12 = December 30, 2012)
            • Brewery-specific date codes
      b. Physical condition of container
         i. Not dented or broken
         ii. No signs of leakage or box weakness
      c. Temperature
         i. Ideally beer will still be cool when it reaches the retailer—the flavor of beer that is warm or hot to the touch may have changed substantially during shipment

B. Serving alcohol
   1. Alcohol's effects
      a. Absorption and elimination
      b. Physical and behavioral indicators
   2. Responsible serving practices
      a. Provide accurate ABV information to consumers
      b. Adjust serving size based on ABV

C. Beer storage
   1. Beer is best consumed fresh

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a. When beer is released from the brewery, it is ready to drink
b. A very few strong or intensely flavored beers may age in ways that make them interesting to drink months or years later if properly cellared

2. Freshness can be preserved and enhanced by wholesaler and retailer actions
   a. Rotate inventory
      i. Ensure that beer is consumed in the order of dating
      ii. Remove out of date products from service inventory
      iii. When beers lack an expiration date:
         - Non-pasteurized draft beer about 45-60 days (refrigerated)
         - Pasteurized draft beer about 90-120 days (refrigerated)
         - Bottled beer:
            - If kept refrigerated, can be good for up to six months
            - When not refrigerated or if subjected to other stresses, may be noticeably off after three months
            - Taste aged product against fresh product to determine deterioration
      iv. Train staff to encourage/sell/promote all beers offered
   b. Store beer properly
      i. Refrigerated storage is best for all beers at all times. Required for draft beer and many craft beers
      ii. Non-refrigerated storage accelerates aging and development of off flavors
         - With time, all beers will develop signs of oxidation (papery, wet cardboard flavors)
         - Possible autolysis of yeast when present (meaty)
         - Possible development of microbial off flavors (sour, buttery, phenolic, other)
      iii. Bottled beers are subject to skunking
         - Caused by sunlight and fluorescent light
         - Most noticeable in the aroma of the beer
         - Brown glass blocks 98% of the wavelengths of light that cause skunking, and therefore offers superior protection to clear and green glass
         - Green glass blocks 20% of the wavelengths that cause skunking
         - Clear glass offers no protection against skunking
         - Skunking may be evident after a few minutes of light exposure
         - Cans, ceramic bottles, and bottles in closed case boxes that completely shield beer from light give maximum protection from skunking
   c. Serve beer properly
      i. Draft beer must be served using CO_2 or a CO_2-nitrogen mix at the proper pressure setting
      ii. Compressed air should never be used instead of CO_2 or a CO_2-nitrogen mix in a draft dispense system

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iii. Bag-in-box or "KeyKeg" style kegs that separate the applied gas from the beer with a flexible plastic barrier can be pressurized with compressed air.
iv. A party pump limits the flavor stability of the beer to **less than one day** because oxygen and airborne contaminants are put in contact with the beer

D. Draft principles
1. CO_2 pressure is applied to maintain carbonation of the beer during dispense
a. Each beer is carbonated to a specific value. Brewer or brand owner provides this information to retailer
b. Temperature, pressure, and gas blend combination must match this specification
2. Movement of beer to tap must overcome system resistance from:
a. Friction in lines
b. Change in elevation
c. Possible variable resistance device on tap
3. Force needed to overcome that resistance comes from two potential sources:
a. Total gas pressure applied to keg
b. Beer pumps

E. On-premises draft systems and their maintenance
1. Anatomy of a standard keg
a. Common commercial volumes
b. Awareness of variety in keg valve systems/coupler types
c. Internal structure of the keg
2. Pressure side components, anatomy and function
a. Gas sources
b. Cylinder/bulk tank
c. Nitrogen generator
d. Air compressor
i. **Never** use with traditional keg
ii. May be used with "bag-in-ball" type kegs (e.g., KeyKeg)
e. Gas blender
f. Primary and secondary regulators
g. Gas line
h. Couplers
3. Beer side components, anatomy and function
a. Couplers
b. Jumper line
c. FOB detectors
d. Wall brackets
e. Trunk line (an insulated bundle of beer line and glycol line)
f. Power packs (glycol chillers)
g. Beer line (vinyl, barrier, stainless, etc.)
h. Draft tower
i. Beer faucets
i. Standard (rear shutoff) faucet

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ii. Nitro faucet

4. Types of US draft systems
   a. Direct draw
   b. Air-cooled
   c. Glycol-cooled
5. Draft system design
   a. System balance
      i. Dynamic resistance
      ii. Static resistance
6. Draft system operation
   a. Standard temperature of 38 °F (3 °C)
   b. Troubleshooting (for each system type)
      i. No beer at faucet
      ii. Beer foaming
      iii. Flat beer
      iv. Cloudy beer
7. Draft system maintenance
   a. Cleaning of lines, faucets, couplers, and FOBs
   b. Goals of cleaning
   c. Use proper personal protective equipment (gloves, goggles, rubber apron)
   d. Criteria for proper cleaning
      i. Frequency
      ii. Cleaner type
      iii. Concentration
      iv. Temperature
      v. Method and contact time
      vi. Flow rate (for dynamic cleaning)
   e. Manual cleaning of components
   f. Cleaning system components
   g. Operation of line cleaning process
   h. Safety issues: operator, consumer

F. Beer glassware
   1. Select appropriate glassware
      a. Size
         i. Based on style and alcohol content (stronger beers, smaller glass)
         ii. Provide room for an appropriately sized head
      b. Shape
         i. Cultural and historical traditions
         ii. Aesthetics of presentation
         iii. Flavor and aroma effects
      c. Brand
         i. Branded glasses matched to beer
   2. Use beer clean glassware
      a. Glass cleaning procedure – three-sink method
         i. Empty glass into open drain
         ii. Wash with non-petroleum based (sudsless) soap and brush

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iii. Rinse in cold water, heel in, heel out
iv. Rinse in sanitizer, heel in, heel out
v. Dry inverted on rack so air circulates inside
vi. Rinse with cold water immediately before dispense

b. Glass cleaning procedure – glass washing machine
i. Use machine dedicated to beer glassware ONLY (do not clean dishes or glassware with food or dairy residue)
ii. Use correct detergent and sanitizer—check concentrations daily or follow detergent and sanitizer supplier recommendations
iii. Water temperature should range between 130 and 140 °F (54-60 °C). High temperature machines designed to operate at 180 °F (82 °C) may be used in place of chemical sanitizers (though local health departments may have additional requirements)
iv. Maintain washer to assure proper water flow through each nozzle and washer arm
v. Regularly service machine following manufacturer's guidelines to ensure proper operation

c. Checking glass for "beer clean"
i. Without beer
- Sheeting (wet glass, empty, water should sheet off of glass evenly; formation of droplets or webbing indicates not beer clean)
- Salt test (wet glass, sprinkle salt throughout; places where salt does not adhere are not beer clean)

ii. With beer
- Head size, shape, retention
- Bubbles clinging to sides of glass (in liquid beer) indicate **not** beer clean
- During consumption, lace will cling to the side of a beer clean glass following each sip

d. Preparation to serve
i. Glass temperature
- Room temperature and chilled glasses are acceptable
- Frozen/frosted glasses are not recommended: causes foaming, makes beer too cold, frozen water or sanitizer may be present

ii. Cold water rinse of glass before filling
- Removes residual sanitizer
- Cools glasses that may be warm from washing
- Aids ideal head formation and retention

G. Serving bottled beer
1. Prepare for service
a. Bottle-conditioned beer should be stored upright prior to service
b. If possible, store beer at ideal serving temperature as dictated by style, otherwise store all beer under refrigeration (43 °F/6 °C or less)
2. Examine bottle
a. Look for white flakes (snow-like), which can indicate old, unstable beer. Do not serve beer in this condition

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b. Look for a thin ring of gunk at liquid level in neck—generally indicative of a bad bottle if present. Do not serve beer in this condition
c. Check for yeast on bottom of bottle
    i. Retain yeast in bottle unless:
        • Consumer requests yeast to be poured
        • Style (e.g., Weissbier) is traditionally poured with yeast
    ii. To pour yeast, rouse by swirling, rolling, or inverting

3. Opening bottle: twist-off, pry-off, cork, combo
    a. Twist-off caps
        i. Twist off by hand
        ii. Napkin may be used to aid grip and protect hand
    b. Pry-off caps
        i. Prefer openers with a bar or other lift area at least ¼ inch (6 mm) wide to prevent possibility of breaking the bottle during opening
        ii. Lift in one motion
    c. Mushroom cork
        i. Remove wire cage by untwisting the tab
        ii. Remove cork by hand—napkin may aid grip
        iii. Be gentle so as not to disturb sediment and make beer volatile
        iv. Practice cork safety—keep bottle pointed away from consumer at all times
    d. Cap plus cork: corkscrew will be required after removing cap
    e. Present the cork (always) or the cap of a rare, unusual, or new beer, to the consumer
    f. Check bottle lip: do not serve beer from bottles with broken/damaged lips
    g. Also examine bottle lip for rust, dried beer, or yeast that could affect flavor or appearance of beer
4. Pouring bottled beer
    a. Filtered beer
        i. Beers bottled without yeast or other sediment—the entire contents of the bottle can be poured into the glass
        ii. Hold glass at 45-degree angle, pour down the side until glass is half full
        iii. Gently tilt glass upright and pour down the middle to create approximately one inch (2.5 cm) of foam head on the beer as the pour finishes. Weizens and Belgian ales traditionally have two to four inches (5-10 cm) of head
    b. Unfiltered beers
        i. Some beers are packaged with yeast in the bottle or completely unfiltered
        ii. Unfiltered beer should still be poured using the method described above in section I.G.4.a
        iii. In most cases, yeast should be retained in the bottle. Be prepared to stop pouring when the yeast moves toward the top of the bottle
        iv. When in doubt about pouring yeast, ask the consumer their preference

H. Serving draft beer
1. Pouring a beer
    a. Hold glass at 45-degree angle, one inch (2.5 cm) below the tap faucet
    b. Grip faucet handle near the base, pull forward to the fully open position to start the flow of beer—when a faucet is only open partially, beer will pour foamy

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c. Pour down the side until glass is half full
d. While continuing to pour gently tilt glass upright and pour down the middle to create appropriate amount of head on the beer as the pour finishes
e. Close faucet as foam cap reaches the top of the glass to prevent beer waste
f. **Never** put faucet in contact with the glass or allow it to become immersed in beer in the glass

2. Pouring nitro beer
   a. Hold glass at 45-degree angle, one inch (2.5 cm) below the faucet. Do not allow faucet to come in contact with the glass or its contents during dispense
   b. Pull tap handle forward to the fully open position to start the flow of beer
   c. Pour down the side until glass is three-quarters full
   d. Settle for 1-2 minutes then fill to the top, with head in accordance with brand-owner's directions
3. Changing a keg (same product)
   a. Kegs must be chilled to draft system operating temperature (generally 38 °F/3 °C) before tapping and serving—general guideline is 24 hours in cooler before serving
   b. For D-, G-, S-, and U-type couplers:
      i. Grip keg coupler handle, pull out and raise to the "up" or "off" position to disengage. Turn the coupler a quarter turn (90 degrees) counterclockwise to unseat. Lift off of the keg
      ii. Seat the coupler on a new keg. Turn clockwise a quarter turn (90 degrees) to lock the coupler in place, then lower the coupler handle to the "down" or "on" position to engage
   c. For A- and M-type couplers:
      i. Grip keg coupler handle, depress the button on the underside of the handle (if a button is present), and raise to the "up" or "off" position to disengage. Slide the coupler off of the keg valve
      ii. Slide the coupler on to the keg valve of a new keg. Lower the coupler handle to the "down" or "on" position to engage
   d. When present, the foam-on-beer (FOB) detector for the keg needs to be reset after a keg change. This is usually done by venting the FOB mechanism to release foam and gas from the chamber
4. Changing products on a line
   a. Ensure that the proper coupler for the new product is correctly installed
   b. If necessitated based on contrast between products:
      i. Rinse or clean lines
      ii. Replace jumper hose (in extreme cases)
   c. Ensure that gas blend and pressure are properly set for the new product

I. Special situations
1. Growlers and draft beer to go
   a. Filling techniques and shelf life
   b. Closures (open container laws)
   c. Cleaning and reusing growlers
   d. Safety considerations
2. Temporary draft systems

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a. Picnic pump/party tap
b. Jockey box
    i. Coil style
    ii. Cold plate

3. Real ale from cask
    a. Definition of real ale (CAMRA)
    b. Ingredients required to achieve carbonation
    c. Real ale serving systems and their use
        i. Gravity dispense
        ii. Beer engine
            • Short spout
            • Swan neck
    d. Anatomy of a cask
    e. Cellaring real ale: soft and hard spiles, tapping, assessing readiness for service
    f. Use of sparklers
4. KeyKeg/one-way keg/"bag-in-ball" keg

II. Beer Styles

A. Understanding beer styles
    1. The historical development of beer styles
        a. First driven by available ingredients, equipment, and water
        b. Shaped by technology, taxes and regulations, culture, consumer appeal, etc.
    2. Cataloged today in the US, principally by
        a. Beer Judge Certification Program[1]
        b. Brewers Association[2]

B. Style parameters
    1. Knowledge requirements
        a. Upper and lower quantitative limits for ABV, IBUs, and SRM for all styles
        b. Qualitative understanding of carbonation and mouthfeel for all styles
        c. Three commercial examples covering classic producers, American producers, and other notable producers of the style globally
    2. Quantitative parameters of beer character
        a. Alcohol content
        b. International Bitterness Units
        c. Color
            i. SRM
        d. Carbonation
        e. Original Gravity
        f. Apparent attenuation
    3. Qualitative parameters of beer character
        a. Aroma

[1] The Cicerone® Certification Program uses the 2015 BJCP Style Guidelines as the reference source for all matters related to style in its exams. You can access the guidelines online at www.bjcp.org and through their mobile device apps.

[2] Certified Cicerone® and Advanced Cicerone™ candidates should be aware of the Brewers Association guidelines. Master Cicerone® candidates should have familiarity with the general differences between the BA and BJCP guidelines, and should have knowledge of BA categories that do not exist in the BJCP guidelines.

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b. Flavor
c. Aftertaste
d. Mouthfeel
e. Perceived bitterness
f. Appearance

C. History, characteristics, and flavor attributes of styles by region
1. Belgium and France
a. Lambic beers
i. Lambic
ii. Gueuze
iii. Fruit Lambic (Kriek, Framboise, etc.)
b. Flanders ales
i. Flanders Red Ale
ii. Oud Bruin
c. Trappist and abbey ales
i. Belgian Dubbel
ii. Belgian Tripel
iii. Belgian Dark Strong Ale
d. Pale Belgian beers
i. Blond Ale
ii. Belgian Pale Ale
iii. Belgian Golden Strong Ale
e. Unique beers
i. Saison
ii. Bière de Garde
iii. Witbier
2. Britain and Ireland
a. England
i. Pale ales
• Ordinary Bitter
• Best Bitter
• Strong Bitter
• English IPA
ii. Dark ales
• Dark Mild
• British Brown Ale
• English Porter
• Sweet Stout
• Oatmeal Stout
• Foreign Extra Stout
iii. Strong ales
• Old Ale
• English Barleywine
b. Scotland
i. Scottish Light
ii. Scottish Heavy

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iii. Scottish Export
iv. Wee Heavy

c. Ireland
i. Irish Red Ale
ii. Irish Stout

3. Germany, Czech Republic, and Austria
a. Lagers
i. Pale
- German Pils
- Munich Helles
- Czech Premium Pale Lager

ii. Amber or dark
- Vienna Lager
- Festbier
- Märzen
- Munich Dunkel
- Schwarzbier
- Rauchbier

iii. Bocks
- Helles Bock
- Dunkles Bock
- Doppelbock
- Eisbock

b. Ales
i. Wheat beers
- Weissbier
- Dunkles Weissbier
- Weizenbock
- Berliner Weisse
- Gose

ii. Rhine Valley ales
- Altbier
- Kölsch

4. United States
a. Pale lagers
i. American Light Lager
ii. American Lager

b. Pale ales
i. American Wheat Beer
ii. American Blonde Ale
iii. American Pale Ale
iv. American Amber Ale

c. IPAs
i. American IPA
ii. Double IPA
iii. Specialty IPA

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- Black IPA
- White IPA

d. Dark ales
   i. American Brown Ale
   ii. American Porter
   iii. American Stout
   iv. Imperial Stout

e. Strong ales
   i. American Barleywine

f. Historic styles
   i. Cream Ale
   ii. California Common

g. Beers made with special ingredients or processes
   i. Alternate grains and malts (e.g., rye)
   ii. Smoked malts
   iii. Sugars and other non-malt fermentables (e.g., honey)
   iv. Fruits and vegetables
   v. Herbs, spices, and natural flavorings (e.g., coffee, chocolate)
   vi. Fermentation with non-Saccharomyces organisms (e.g., *Brettanomyces* species)
   vii. Fermentation or aging with barrels/wood of various types

5. Other regions
   a. International
      i. International Pale Lager
   b. Scandinavia
      i. Baltic Porter

III. Beer Flavor and Evaluation

A. Taste and flavor
   1. How we perceive flavor
      a. Aroma
         i. Orthonasal
         ii. Retronasal
      b. Taste
         i. Established
            - Sweet
            - Salty
            - Sour
            - Bitter
            - Umami
         ii. Emerging
            - Fat
      c. Mouthfeel
         i. Body
         ii. Carbonation
         iii. Astringency

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iv. Creaminess
v. Alcoholic warming

2. Variations in taste perception
   a. Genetic and biological differences
   b. Physiological factors
   c. Personal/behavioral factors
      i. Smoking, coffee, food preferences
      ii. Consumption habits
   d. Mental and psychological factors
3. Beer evaluation
   a. Setting and tools
      i. Environment for tasting
      ii. Drinking vessels and other accessories
      iii. Beer temperature
   b. Components of evaluation
      i. Appearance
      ii. Flavor profile
         - Aroma
         - Taste
         - Mouthfeel
         - Aftertaste
   c. Key evaluation techniques
      i. Aroma techniques
         - Distant Sniff: Swirl beer while holding glass six to eight inches (15-20 cm) away from nose and take one to two short sniffs
         - Short Sniff: Swirl beer; bring glass to nose and take one to two short sniffs
         - Long Sniff: Swirl beer; bring glass to nose and take one long sniff
         - Covered Sniff: Cover glass with hand; swirl beer for three to five seconds; bring glass to nose, remove hand, and sniff
      ii. Use consistent background to assess color and clarity
      iii. Beer should reach all parts of tongue during tasting
      iv. Flavor perception continues after swallowing

B. Identify normal flavors of beer and their source
   1. Malt and grain flavors
      a. Pale beer: Uncooked flour, bread dough
      b. Golden beer: White bread, wheat bread, water cracker
      c. Light amber beer: Bread crust, biscuit, graham cracker
      d. Amber beer: Toast, caramel, pie crust
      e. Brown beer: Nutty, toffee, chocolate, dark/dried fruit
      f. Black beer: Roast, burnt, coffee
   2. Hops
      a. Bitterness, flavor and aroma effects
      b. Traditional regional hop traits
         i. American: Piney, citrus, resiny, tropical fruit, catty
         ii. English: Earthy, herbal, woodsy

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iii. German/Czech: Floral, perfumy, peppery, minty

3. Fermentation flavors
   a. Ale versus lager flavors
   b. Weizen yeast flavor
   c. Acidic fermentation (lactic, acetic)
   d. Brettanomyces

C. Identify common beer off flavors by name and source
1. From *Saccharomyces cerevisiae*
   a. Diacetyl
   b. Sulfur flavors
      i. H_2S (hydrogen sulfide)
   c. Acetaldehyde
   d. Phenols
      i. Know range of flavors associated with phenols
      ii. 4-vinylguaiacol
   e. Esters
      i. Know range of flavors associated with esters
2. From other organisms
   a. Diacetyl
   b. Phenols (see 1d above)
   c. Acetic acid
   d. Lactic acid
3. Packaging and storage
   a. Oxidation/aging flavors
      i. Honey
      ii. Papery/wet cardboard (trans-2-nonenal)
      iii. Waxy/lipstick
      iv. Sherrylike
      v. Increased toffee/caramel
      vi. Decreased bitterness
   b. Lightstruck/skunky
   c. Autolysis
4. Process and ingredients
   a. Isovaleric acid
   b. Metallic
   c. DMS
   d. Astringent/tannic

D. Perform the following under test conditions:
1. By taste, detect and identify a limited set of off-flavors (acetaldehyde, acetic acid, diacetyl, DMS, and trans-2-nonenal) by comparing spiked samples to a control beer
2. By taste, correctly categorize a sample as one of two beer styles
3. Based on your analysis of a given commercial example, identify whether the sample is fit for service or whether the sample exhibits flaws caused by improper handling

IV. Beer Ingredients and Brewing Processes

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A. Ingredients
  1. Grains
    a. Malted barley
      i. Why barley used for brewing
      ii. Species of barley, cultivation areas
      iii. Malting: process stages and steps
      iv. Process variations that lead to different malt types
        • Kilned: Pils, Pale Ale, Vienna, Munich, Victory
        • Stewed: Crystal/caramel malts
        • Roasted: Chocolate, Black Patent
    b. Wheat, oats, rye, and other specialty grains
      i. Sensory contributions to finished product
    c. The use of corn and rice in beer
      i. Contributions to wort and beer
      ii. Requirements for processing
      iii. Styles where used
  2. Hops
    a. Anatomy of hop plant and cone
    b. Cultivation
      i. Structure and layout of hop field
      ii. Harvesting, drying, and baling
      iii. Storage and delivery to breweries
    c. Major growing regions
      i. Continental Europe
        • Germany
        • Czech Republic
        • Belgium
        • Slovenia
        • Poland
        • France
      ii. Britain
      iii. United States
        • Yakima Valley, Washington
        • Oregon
        • Idaho
      iv. Australia and New Zealand
    d. Categories of hops
      i. Bittering hops (high alpha acid)
      ii. Aroma hops (desirable flavor and aroma properties)
        • Noble hops (Hallertau Mittelfruh, Spalt, Tettnang, Saaz)
      iii. Dual use hops (possessing properties of both bittering and aroma hops)
    e. Chemistry
      i. Alpha acids, isomerization, and IBUs
      ii. Hop oils determine flavor and aroma
    f. Hop forms and products used in brewing
      i. Whole hops

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ii. Pellet hops
iii. Extracts
- Alpha acid
- Hydro-isomerized alpha acid (skunk resistant)

g. Uses and effects during brewing
i. Bittering contribution of hops added at different times during the boil
ii. Flavor and aroma hop additions and effects
- Boil
- Hot wort steep/whirlpool
- Dry hopping

3. Yeast
a. Taxonomy
i. Ale yeast
- *Saccharomyces cerevisiae*
- Generally produce esters in levels which give fruity flavors to finished beers
- Some possess a phenolic off-flavor gene (POF+) which results in production of phenolic flavors such as clove, nutmeg, white pepper

ii. Lager yeast
- *Saccharomyces pastorianus* also known as *Saccharomyces carlsbergensis*
- Generally do not produce esters or phenols in appreciable quantities, resulting in a focus on malt and hop character

iii. Wild yeast
- Non-brewing strains of *Saccharomyces* can cause off flavors or excessive attenuation

b. Non-*Saccharomyces* organisms
i. Important organisms
- *Brettanomyces* species
- *Acetobacter* species
- *Lactobacillus* species
- *Pediococcus* species

ii. Intentional use
iii. Unintentional appearance

4. Water
a. The importance of water in brewing
b. Chemistry of water
i. Chlorine
- Off flavors associated with chlorine
- Common techniques for removal

ii. Water cycle and sources of salts
iii. Water traits of classic brewing cities: Munich, Pilsen, Burton-on-Trent

5. Other ingredients
a. Specialty ingredients
i. Sugars
- Fermentable

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- Corn sugar/dextrose/glucose
- Candi sugar
- Honey, molasses

• Non-fermentable
- Lactose

ii. Fruits and vegetables
iii. Herbs and spices
• Common cooking herbs/spices
• Chili peppers
• Coffee, cocoa, chocolate, teas

b. Historical precedent for addition of non-traditional ingredients

B. Processes
1. Milling
a. Possible flavor impact of milling on finished beer
2. Mashing
a. General description and goals
b. Awareness of other mashing methods (cereal mash, step mash, decoction mash)
3. Lautering
a. Objectives of lautering
b. General process of lautering
i. Initiate wort run-off
ii. Vorlauf (recirculation)
iii. Begin collection of wort for boiling
iv. Sparge
4. Boiling
a. Process and objectives of boiling
i. Inputs and outputs
ii. Significant physical and chemical changes
b. Flavor impacts of boil
5. Whirlpool
a. Objectives of whirlpool
b. General operation of whirlpool including wort removal
6. Chilling
a. Modern methods of wort chilling
i. Heat exchanger
ii. Coolship
b. Flavor issues associated with wort chilling
7. Aeration and pitching
a. When wort is aerated in the brewing process
b. Reasons for wort aeration
8. Fermentation (*Saccharomyces cerevisiae or Saccharomyces pastorianus*)
a. General description of fermentation
i. Ale fermentation
ii. Lager fermentation
b. Major biochemical inputs and outputs

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i. Input: Sugars
ii. Outputs: Alcohol and carbon dioxide
c. Resulting flavor compounds (see flavor section, III.C.1)
d. Equipment used for fermentation
e. Variations in fermentation temperature and their flavor impact

9. Lagering
a. Objectives of lagering
b. Lagering temperature and duration
c. Impact on finished beer characteristics

10. Aging
a. Flavor impacts of aging
i. In stainless steel
ii. In new wood
iii. In previously used wood
b. Factors influencing flavors produced
i. Prior use of vessel
• Residual flavors from other liquids
• Microflora

11. Clarification
a. Common methods used for beer clarification
i. Filtration
ii. Finings
iii. Settling/aging

12. Carbonation
a. Carbonation levels found in beer (by style or type) in volumes of CO_2
b. Methods of achieving carbonation in beer, when and how used
i. Capture during fermentation
ii. Forced carbonation
iii. Secondary fermentation in serving vessel
c. Sensory impact of carbonation on finished beer

13. Packaging and pasteurization
a. Package types
i. Draft
ii. Bottles
iii. Cans
b. Force-carbonated vs. package conditioned (e.g., bottle conditioned)
c. Quality control
i. Cleaning/sanitizing of containers
ii. Importance of air exclusion during packaging
iii. Cap-on-foam
d. Pasteurization and its impact on beer
i. Impact on stability and flavor

V. Pairing Beer with Food

No single model perfectly explains all the dynamics of beer and food pairing. This syllabus draws from various sources to present common concepts and accepted principles. Candidates

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can expect exam questions on the following guidelines. They will also be asked to demonstrate an understanding of these concepts by naming beers or beer styles to pair with various foods and dishes.

A. Possible outcomes of successful beer and food pairings
   1. Desirable flavors are highlighted in both the beer and the dish
   2. Combination of the two invokes memory, emotion, and/or deeper thought
   3. Pairing creates new flavors not originally present in either the beer or the dish

B. Beer and food vocabulary
   1. Beer vocabulary
      a. For common beer flavor descriptors, see section III.B
   2. Food vocabulary
      a. Describe specific food tastes beyond basic identification of key ingredients and preparation (e.g., instead of "seared scallop", use "scallop has a caramelized, crispy sear with rich toasted and toffee flavors, while the dense interior has a buttery sweetness")
      b. Understand basic cooking techniques and their effects on flavor (e.g., poaching, roasting, frying, etc.)
      c. Familiarity with a range of commonly encountered foods and ingredients (e.g., vegetables, fruits, herbs, spices, etc.)

C. Pairing concepts
   1. Intensity (sometimes referred to as "impact" or "weight")
      a. A beer's intensity is determined by the levels of several characteristics
         i. Malt flavor
         ii. Hop bitterness
         iii. Sweetness/body (note that these are related)
         iv. Alcohol content
         v. Carbonation
         vi. Tartness/sourness
         vii. Fermentation derived flavors (esters, phenols, etc.)
         viii. Hop flavor/aroma
         ix. Special ingredients/processes (e.g., fruit, coffee, barrel-aging, etc.)
      b. A dish's intensity is determined by the interplay of several characteristics
         i. Flavor impact of individual ingredients
         ii. Preparation/cooking method
         iii. Spices used
         iv. Sauces served alongside
         v. Levels of fat, umami, sweetness, bitterness, saltiness, sourness, etc.
   2. Flavor interactions
      a. Interactions between similar flavors
         i. Complement/resonance—Similar or compatible flavors present in both the beer and the food complement one another (e.g., an Indian curry with cloves resonates with the clove flavors found in a Dunkles Weissbier)
      b. Interactions between dissimilar flavors
         i. Contrast—By offering an opposing flavor, the beer highlights a flavor in the dish or vice versa. (e.g., mussels served with gueuze seem richer and sweeter due to the acidity of the beer)

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ii. Cut—Some beer traits help refresh the palate by lifting, cleansing, or removing rich or fatty flavors from the palate. Common "cutting" beer traits include carbonation, sourness, and bitterness, and to a lesser extent, alcohol and roastiness

D. Common beer and food interactions
   1. Malt flavors
      a. Complement toasted and caramelized flavors in a variety of foods
      b. Soothe/soften capsaicin "heat"
   2. Hop flavors
      a. Depending on hop variety, can complement fruit, citrus, herb, and spice flavors
   3. Fermentation-derived flavors
      a. Esters
         i. Harmonize with fruit flavors
      b. Phenols (clove and peppercorn flavors)
         i. Resonate with spices
         ii. Contrast fat and umami
   4. Carbonation
      a. Cuts fat, umami, and sweetness
      b. Accentuates capsaicin "heat"
   5. Bitterness
      a. Cuts fat, umami, and sweetness
      b. Accentuates capsaicin "heat"
      c. Can create harsh or metallic effects with certain foods (e.g., oily fish)
      d. Can harmonize with bitter foods (e.g., bitter salad greens)
   6. Roastiness
      a. Complements chocolate, caramelized, and burnt flavors
      b. Cuts fat
      c. Contrasts sweetness
   7. Alcohol
      a. Can cut fat
      b. Generally resonates with sweetness
      c. Can accentuate capsaicin "heat"
   8. Tartness/sourness
      a. Can brighten some food flavors
      b. Can complement or accentuate sour flavors
      c. May favorably contrast fat, umami, or salt
   9. Sweetness
      a. Soothes capsaicin "heat" and other spices
      b. Accentuated by saltiness

E. Creating a pairing
   1. Match intensities of both beer and dish so that neither overpowers the other
   2. Consider the flavor interactions listed in sections V.C.2 and V.D to hone the pairing

F. Designing a meal
   1. Intensity of dishes and pairings generally increases as the meal progresses

G. Classic beer and food pairings

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1. European traditions
2. Recommended literature
    a. *Brewmaster's Table*, Garrett Oliver
    b. *Tasting Beer*, Randy Mosher

H. Cooking with beer
1. Common uses
    a. Used in place of water or other liquid as an ingredient or cooking medium
2. Flavor effects
    a. Concentrating beer through cooking intensifies non-volatile flavors
        i. Bitterness can intensify exponentially and may become unpleasant
        ii. Malt flavors and sweetness increase, sugars caramelize
        iii. Volatile hop and ester flavors decrease and may disappear entirely
        iv. Astringent/burnt flavors of roasted malt can increase and may become unpleasant
    b. Delicate hop and fermentation flavors in beer can be brought to a dish by not cooking the beer (e.g., using an IPA in a salad dressing)

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