Cicerone® Certification Program
International Certified Cicerone® Syllabus

Updated 20 November, 2017

This syllabus outlines the knowledge required of those preparing for the Certified Cicerone® exam outside of the United States, Canada, the UK, Australia, or New Zealand. 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. 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 flavour 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
      a. When beer is released from the brewery, it is ready to drink
      b. A very few strong or intensely flavoured 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 Remove out of date products from service inventory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-pasteurised draught beer about 45-60 days (refrigerated)
            - Pasteurised draught 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 draught beer and many craft beers
   ii. Non-refrigerated storage accelerates aging and development of off flavours
      - With time, all beers will develop signs of oxidation (papery, wet cardboard flavours)
      - Possible autolysis of yeast when present (meaty)
      - Possible development of microbial off flavours (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. Draught 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 draught dispense system
   iii. A party pump limits the flavour 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 draught 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. Draught tower
   i. Beer faucets
      i. Standard (rear shutoff) faucet
      ii. Nitro faucet
4. Types of US draught systems
   a. Direct draw
   b. Air-cooled
   c. Glycol-cooled
5. Draught system design
   a. System balance
      i. Dynamic resistance
      ii. Static resistance
6. Draught system operation
   a. Standard temperature of 3 °C (38 °F)
   b. Troubleshooting (for each system type)
      i. No beer at faucet
      ii. Beer foaming
      iii. Flat beer
      iv. Cloudy beer
7. Draught system maintenance
   a. Cleaning of lines, faucets, couplers, and FOBs
   b. Goals of cleaning
   c. Criteria for proper cleaning
      i. Frequency
      ii. Cleaner type

iii. Concentration
iv. Temperature
v. Method and contact time
vi. Flow rate (for dynamic cleaning)

d. Manual cleaning of components
e. Cleaning system components
f. Operation of line cleaning process
g. 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. Flavour 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
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 54-60 °C (130-140 °F). High temperature machines designed to operate at 82 °C (180 °F) 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
b. 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

c. 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 (6 °C/43 °F 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
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 6 mm (¼ inch) 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 flavour 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 2.5 cm (one inch) of foam head on the beer as the pour finishes. Weizens and Belgian ales traditionally have 6-8 mm (2-4 inches) 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

H. Serving draught beer
   1. Pouring a beer
      a. Hold glass at 45-degree angle, 2.5 cm (one inch) 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
      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. Changing a keg (same product)
      a. Kegs must be chilled to draught system operating temperature (generally 3 °C/38 °F) before tapping and serving—general guideline is 24 hours in cooler before serving
      b. For D-, G-, S-, and U-type couplers:
         1. 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
         2. 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:
         1. 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
         2. 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. In long-draw systems that use them, 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

3. 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 draught beer to go
   a. Filling techniques and shelf life
   b. Closures (open container laws)
   c. Cleaning and reusing growlers
   d. Safety considerations
2. Temporary draught systems
   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. Catalogued today in the US, principally by
   a. Beer Judge Certification Program[1]
   b. Brewers Association[2]

[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.

B. Style parameters
   1. Knowledge requirements
      a. Upper and lower quantitative limits for ABV, IBUs, and EBC/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. Colour
         i. EBC/SRM
      d. Carbonation
      e. Original Gravity
      f. Apparent attenuation
   3. Qualitative parameters of beer character
      a. Aroma
      b. Flavour
      c. Aftertaste
      d. Mouthfeel
      e. Perceived bitterness
      f. Appearance

C. History, characteristics, and flavour 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] 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.

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
        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
         - 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
   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 flavourings (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 Flavour and Evaluation

A. Taste and flavour
  1. How we perceive flavour
    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
      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. Flavour profile
        - Aroma
        - Taste
        - Mouthfeel
        - Aftertaste
    c. Key evaluation techniques
      i. Aroma techniques
        - Distant Sniff: Swirl beer while holding glass 15-20 cm (6-8 inches) 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

ii. Use consistent background to assess colour and clarity
iii. Beer should reach all parts of tongue during tasting
iv. Flavour perception continues after swallowing

B. Identify normal flavours of beer and their source
1. Malt and grain flavours
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, flavour and aroma effects
b. Traditional regional hop traits
i. American: Piney, citrus, resiny, tropical fruit, catty
ii. English: Earthy, herbal, woodsy
iii. German/Czech: Floral, perfumy, peppery, minty
3. Fermentation flavours
a. Ale versus lager flavours
b. Weizen yeast flavour
c. Acidic fermentation (lactic, acetic)
d. Brettanomyces

C. Identify common beer off flavours by name and source
1. From *Saccharomyces cerevisiae*
a. Diacetyl
b. Sulfur flavours
i. H_2S (hydrogen sulfide)
c. Acetaldehyde
d. Phenols
i. Know range of flavours associated with phenols
ii. 4-vinylguaiacol
e. Esters
i. Know range of flavours 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 flavours
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 flavours (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

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 flavour 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, isomerisation, and IBUs
ii. Hop oils determine flavour and aroma

f. Hop forms and products used in brewing
i. Whole hops
ii. Pellet hops
iii. Extracts
- Alpha acid
- Hydro-isomerised alpha acid (skunk resistant)

g. Uses and effects during brewing
i. Bittering contribution of hops added at different times during the boil
ii. Flavour 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 flavours to finished beers
- Some possess a phenolic off-flavour gene (POF+) which results in production of phenolic flavours 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 flavours 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 flavours 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
            - 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 flavour 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. Flavour 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. Flavour 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
i. Input: Sugars
ii. Outputs: Alcohol and carbon dioxide
c. Resulting flavour compounds (see flavour section, III.C.1)
d. Equipment used for fermentation
e. Variations in fermentation temperature and their flavour impact
9. Lagering
a. Objectives of lagering
b. Lagering temperature and duration
c. Impact on finished beer characteristics
10. Aging
a. Flavour impacts of aging
i. In stainless steel
ii. In new wood
iii. In previously used wood
b. Factors influencing flavours produced
i. Prior use of vessel
• Residual flavours 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 pasteurisation
a. Package types
i. Draught
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. Pasteurisation and its impact on beer
i. Impact on stability and flavour

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 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 flavours 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 flavours not originally present in either the beer or the dish
B. Beer and food vocabulary
1. Beer vocabulary
a. For common beer flavour 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 caramelised, crispy sear with rich toasted and toffee flavours, while the dense interior has a buttery sweetness")
b. Understand basic cooking techniques and their effects on flavour (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 flavour
ii. Hop bitterness
iii. Sweetness/body (note that these are related)
iv. Alcohol content
v. Carbonation
vi. Tartness/sourness

vii. Fermentation derived flavours (esters, phenols, etc.)
viii. Hop flavour/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. Flavour 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. Flavour interactions
a. Interactions between similar flavours
i. Complement/resonance—Similar or compatible flavours present in both the beer and the food complement one another (e.g., an Indian curry with cloves resonates with the clove flavours found in a Dunkles Weissbier)
b. Interactions between dissimilar flavours
i. Contrast—By offering an opposing flavour, the beer highlights a flavour in the dish or vice versa. (e.g., mussels served with gueuze seem richer and sweeter due to the acidity of the beer)
ii. Cut—Some beer traits help refresh the palate by lifting, cleansing, or removing rich or fatty flavours 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 flavours
a. Complement toasted and caramelised flavours in a variety of foods
b. Soothe/soften capsaicin "heat"
2. Hop flavours
a. Depending on hop variety, can complement fruit, citrus, herb, and spice flavours
3. Fermentation-derived flavours
a. Esters
i. Harmonize with fruit flavours
b. Phenols (clove and peppercorn flavours)
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, caramelised, and burnt flavours
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 flavours
   b. Can complement or accentuate sour flavours
   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 flavour 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
   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. Flavour effects
      a. Concentrating beer through cooking intensifies non-volatile flavours
         i. Bitterness can intensify exponentially and may become unpleasant
         ii. Malt flavours and sweetness increase, sugars caramelize
         iii. Volatile hop and ester flavours decrease and may disappear entirely
         iv. Astringent/burnt flavours of roasted malt can increase and may become unpleasant
      b. Delicate hop and fermentation flavours in beer can be brought to a dish by not cooking the beer (e.g., using an IPA in a salad dressing)