



Qualifications

Foundations of Brewing and Packaging

Examination Syllabus

Unit 1: Overview of Brewing and Packaging Practices

Topic	Candidates should understand and be able to demonstrate familiarity with:
General knowledge of beer types	<ul style="list-style-type: none"> • A generic, non-legalistic definition of beer in terms of its typical ingredients and methods of production • The characteristics and differentiating raw materials and processes for the principal different types of beer, e.g. ales and other special top-fermented beers (e.g. Belgian beers), wheat beer, lager, stout, low-alcohol, low-carbohydrate
General knowledge of raw materials and processes for brewing	<ul style="list-style-type: none"> • The nature and origins of the raw materials and process aids used in the brewing process • The sequence of events from raw material intake to the finished beer and the typical points of use for raw materials • A visualisation of the brewing processes as a flow diagram
Definition of packaging	<ul style="list-style-type: none"> • The definition of packaging in terms of its aims to meet the needs of customers, consumers and typical regulatory and labelling requirements • The concept of due diligence to ensure consumer safety

Unit 2: Brewing – Raw Materials for Sweet Wort Production

Topic	Candidates should understand and be able to demonstrate familiarity with:
Barley and malt	<ul style="list-style-type: none"> • The role of barley in beer production • The significant changes that occur when the barley grain is malted and the key stages of malting • The principal constituents of malt The key malt parameters (such as, degree of modification, extract content, moisture content, extract, and colour)
Adjuncts and coloured malts	<ul style="list-style-type: none"> • Reasons for the use of adjuncts • Types of adjunct and their method of use • Typical usage rate as proportion of grist • Types of coloured malt and their characteristics • Typical uses of coloured malts

Water	<ul style="list-style-type: none"> • The uses of water in a brewery water sources • The characteristics required for water • The influence of the ionic composition on beer characteristics • Typical water treatments (e.g. removal of alkalinity)
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Unit 3: Brewing – the Conversion of the Starch to Sugars

Topic	Candidates should understand and be able to demonstrate familiarity with:
Mash conversion	<ul style="list-style-type: none"> • The nature of barley starch – its molecular structure • A basic understanding of the roles of the amylases and proteases and the effect of mash conditions on their activity • The range of sugars produced during conversion
Sweet wort composition	<ul style="list-style-type: none"> • The definition of extract • Composition of wort important for fermentation

Unit 4: Brewing – the Plant for Sweet Wort Production

Topic	Candidates should understand and be able to demonstrate familiarity with:
Brewing plant: milling	<ul style="list-style-type: none"> • The purposes of milling with respect to the type of mashing / mash separation systems employed • The operating principles of malt mills and configurations with associated malt preparation equipment • Health and safety aspects of malt handling and milling
Brewing plant: mashing and conversion	<ul style="list-style-type: none"> • The operating principles and diagrammatic representation of typical mashing/mash conversion systems, including cereal cooker • The typical process times and temperatures used
Brewing plant: wort separation	<ul style="list-style-type: none"> • The basic operating principles and diagrammatic presentation of mash tuns, lauter tuns and mash filters • The significance of cycle times for brewhouse capacity • Use of spent grains as a co-product

Unit 5: Wort Boiling

Topic	Candidates should understand and be able to demonstrate familiarity with:
Wort boiling and boiling systems	<ul style="list-style-type: none"> • The purposes of boiling viz. sterilisation, stabilisation of enzyme action, evaporation, coagulation and precipitation of protein (trub formation) and beer haze precursors, development of hop bitterness and other flavour development, colour formation • Factors affecting the effectiveness of wort boiling • The purposes of liquid adjunct additions to the wort kettle • The operating principles of wort kettles (coppers)
Hop bitterness	<ul style="list-style-type: none"> • The hop plant and hop growing regions of the world • Hop preparations • Isomerisation and how hops or hop preparations yield bitterness during wort boiling • How alternative or supplementary additions of hop bitterness may be made at later stages in brewing • How bitterness value of beer is expressed

Unit 6: Wort Clarification, Cooling and Oxygenation

Topic	Candidates should understand and be able to demonstrate familiarity with:
Wort clarification	<ul style="list-style-type: none"> • The potential of trub constituents, spent hops, etc. in boiled wort to detract from beer quality • Methods available for the removal of trub and/or spent hops • The basic operating principles of wort clarification devices
Wort cooling and oxygenation	<ul style="list-style-type: none"> • The effect of cooling on wort constituents • The purposes of wort cooling • Methods available for cooling wort • The purposes of wort oxygenation

Unit 7: The Basic Principles of Yeast Fermentation

Topic	Candidates should understand and be able to demonstrate familiarity with:
Brewing yeast	<ul style="list-style-type: none"> • <i>Saccharomyces</i> species as members of the yeast family of micro-organisms • The differences between lager and ale yeasts in terms of their practical brewing applications • The microscopic appearance of a yeast cell • Yeast multiplication
Yeast handling	<ul style="list-style-type: none"> • Yeast propagation • Cropping and storage of yeast for re-pitching
Fermentation theory	<ul style="list-style-type: none"> • The main phases and events of a brewery fermentation including changes in yeast numbers and specific gravity, and levels of sugars and alcohol
Fermentation and beer flavour	<ul style="list-style-type: none"> • The production of alcohol and carbon dioxide from wort sugars by yeast • Typical examples of the relationship between yeast strain, fermentation conditions and beer quality • A basic understanding of the flavour influence of other fermentation products such as esters, higher alcohols, diacetyl (VDK), and sulphur compounds

Unit 8: Fermentation Practice

Topic	Candidates should understand and be able to demonstrate familiarity with:
Fermentation vessels and fermentation control	<ul style="list-style-type: none"> • General knowledge of the basic features of a brewery fermentation vessel • The operating principles and diagrammatic representation of typical fermentation vessels • Reasons for temperature control • Practical aspects of the phases of typical temperature profiles
High gravity brewing	<ul style="list-style-type: none"> • Reasons for brewing at high gravity and subsequent dilution
Health and safety	<ul style="list-style-type: none"> • The evolution of carbon dioxide from fermentations. • The hazards associated with carbon dioxide and the observance of safety precautions

Unit 9: Beer Maturation and Storage

Topic	Candidates should understand and be able to demonstrate familiarity with:
Maturation	<ul style="list-style-type: none"> • The purposes of warm maturation • Typical times and temperatures for ales and lagers • Typical changes during maturation affecting beer flavour • The purposes of cold storage • Typical times and temperatures appropriate to different beer types • Additions made after maturation • The purposes of carbonation and typical dissolved CO₂ levels for different beer types
Storage, beer movement, dissolved oxygen and beer quality	<ul style="list-style-type: none"> • The reasons for storage and storage times • Preservation of beer quality during storage and transfer to the packaging line • The vulnerability of beer to staling by oxygen – how oxygen stales beer • Sources of dissolved oxygen and the prevention of oxidation • The special requirements for the preparation of dilution water (liquor)

Unit 10: Preparation of Beer for Packaging

The following table applies to those studying for Foundations of Brewing and Packaging: Chilled/Filtered Beer ONLY:

Topic	Candidates should understand and be able to demonstrate familiarity with:
Clarification	<ul style="list-style-type: none"> • Principles of sedimentation and centrifugation
Haze stabilisation	<ul style="list-style-type: none"> • Haze precursors and their removal
Filtration	<ul style="list-style-type: none"> • The purposes of filtration • The principles of filtration – sieving, depth and absorption. The nature and preparation of filter aid – diatomaceous earth (kieselguhr) and perlite • The operating principles of rough beer filters, including cross-flow systems • The potential for filtration operations as sources of excessive effluent

	<ul style="list-style-type: none"> • The health and safety hazards associated with filter aids, the personal protection and the plant safety features necessary
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The following table applies to those studying for Foundations of Brewing and Packaging: Cask Beer ONLY:

Topic	Candidates should understand and be able to demonstrate familiarity with:
Preparation of cask beer	<ul style="list-style-type: none"> • The purposes of cask conditioning • The necessity of a controlled yeast concentration/count, typical values • Conditioning and the necessity for residual fermentable sugars <p>Reasons for the addition of priming sugar</p>
Clarification	<ul style="list-style-type: none"> • Principles of sedimentation and centrifugation • Principles of use of finings • The origin, nature and action of isinglass finings • The origin, nature and action of auxiliary finings
Dry hopping	<ul style="list-style-type: none"> • Types of hops and hop preparations used for cask beer • Reasons for addition of hops or hop preparations

Unit 11: Beer Packaging – General Topics

Topic	Candidates should understand and be able to demonstrate familiarity with:
Package types and packaging line design	<ul style="list-style-type: none"> • A basic general knowledge of different types of packaging containers and their suitability to meet differing market conditions • The basic design features of typical packaging lines
Package volume control	<ul style="list-style-type: none"> • How package filling operations ensure correct fill volumes are achieved
Line capacity, efficiency reporting and loss control	<ul style="list-style-type: none"> • Rate limiting factors and critical processes • The purposes of efficiency reporting • Typical efficiency calculations and the analysis of data • The causes of beer and material losses
Labelling and coding	<ul style="list-style-type: none"> • The purposes of labelling and coding • Container areas (sites) for packaging coding • The reasons for bar coding • The importance of record keeping

Container inspection	<ul style="list-style-type: none"> • The purposes of empty and full container inspection • Checking the effectiveness of inspection and reject systems • The importance of record keeping
Packaging line safety	<ul style="list-style-type: none"> • Noise level control, ear protection • Guarding of machinery • Permit to work systems

Unit 12: Packaging of Beer

The following table applies to those studying for Foundations of Brewing and Packaging: Chilled/Filtered Beer ONLY:

Topic	Candidates should understand and be able to demonstrate familiarity with:
Pasteurisation	<ul style="list-style-type: none"> • The purpose and principles of pasteurisation • The pasteurisation unit (PU) • The principal features of plate (flash) and tunnel pasteurisers, the operational differences between them
Sterile filtration and sterile filling	<ul style="list-style-type: none"> • The reasons for sterile filtration as an alternative to pasteurisation and the different line operations for tunnel pasteurisation and sterile filling • Methods of achieving sterile filtration and their principles • The special installation requirements for sterile filling
Bottle design features	<ul style="list-style-type: none"> • Typical bottle characteristics and materials (glass, PET) • The protection of beer in bottle from ultra-violet light • Basic information about the manufacture of glass and plastic bottles
Can and keg design features	<ul style="list-style-type: none"> • The construction of metal cans and can ends and basic information of their manufacture • The construction of metal kegs and the extraction systems

The following table applies to those studying for Foundations of Brewing and Packaging: Cask Beer ONLY:

Topic	Candidates should understand and be able to demonstrate familiarity with:
Cask washing and racking	<ul style="list-style-type: none"> • Preparation and inspection of casks for filling. • Typical cask racking installations • Cask filling practice, typical temperature specification for beer at racking fill volume control
Control of additions	<ul style="list-style-type: none"> • Additions of finings at rack • Dry hopping procedures
Conditioning in cask	<ul style="list-style-type: none"> • Storage temperature during conditioning, in the supply chain and at the point of sale • The use of soft and hard pegs • Factors influencing shelf life
Dispense	<ul style="list-style-type: none"> • Cellar management • Dispense systems • Factors influencing product dispense life

Unit 13: Beer Quality – Process Control

Topic	Candidates should understand and be able to demonstrate familiarity with:
Product consistency	<ul style="list-style-type: none"> • The variable nature of beer's natural ingredients • The influence of process parameters on final product parameters • The principles of monitoring and adjustment to achieve product consistency • The concept of 'trueness to type' • Simple statistical quality control procedures
Product and process specifications	<ul style="list-style-type: none"> • The purpose of a specification • The concepts of tolerance and range for specification parameter values • Typical specifications which differentiate beer types • Typical process specification ranges, especially those requiring periodic adjustment to achieve product consistency • The key quality parameters and their influence on beer quality

Unit 14: Beer Quality – Flavour

Topic	Candidates should understand and be able to demonstrate familiarity with:
Terminology	<ul style="list-style-type: none"> • The reasons for adopting industry standard descriptors for flavour • The flavour wheel • The more commonly used descriptors
Evaluation and tasting	<ul style="list-style-type: none"> • Difference tests, (e.g. the three-glass test) • Flavour profiling • Trueness to type panel tasting • Taste training procedures

Unit 15: Beer Quality – Microbiological Contamination

Topic	Candidates should understand and be able to demonstrate familiarity with:
Beer spoilage	<ul style="list-style-type: none"> • The substrates present in wort and beer to support microbial growth • Anaerobic growth • Common principal categories of spoilage organisms (<i>viz.</i> <i>Lactobacillus</i>, <i>Acetobacter</i>, wild yeasts <i>sp.</i>) and their effects on beer quality • The appropriate use of flavour descriptors to describe spoilage
Detection and monitoring	<ul style="list-style-type: none"> • Typical laboratory practices for the detection and identification of spoilage organisms

Unit 16: Beer Quality – Quality Management

Topic	Candidates should understand and be able to demonstrate familiarity with:
Describing a quality system; benefits, roles and responsibilities	<ul style="list-style-type: none"> • The key features of a quality system <i>viz.</i>: <ul style="list-style-type: none"> ○ written specifications ○ written procedures ○ document control ○ monitoring of performance ○ corrective actions ○ auditing ○ regular reviews for improvement • The business benefits of an effective quality management system

	<ul style="list-style-type: none"> • The impact of individual actions on product and service quality
Shelf life	<ul style="list-style-type: none"> • Factors affecting shelf life • Strategies to maximise unexpired shelf life at delivery to the retailer

Unit 17: Plant Cleaning

Topic	Candidates should understand and be able to demonstrate familiarity with:
Detergents and sterilants and safety features	<ul style="list-style-type: none"> • The chemical nature of typical detergents and sterilants • The hazards associated with chemical cleaning and sterilising agents • Good practices for the storage and handling of chemicals
Cleaning-in-place (CIP) systems and hygiene factors of plant design	<ul style="list-style-type: none"> • The operating principles and diagrammatic representation of typical CIP systems • Plant design – hygiene considerations

Unit 18: Engineering Maintenance

Topic	Candidates should understand and be able to demonstrate familiarity with:
Approaches and tasks	<ul style="list-style-type: none"> • The business motives for an effective maintenance system • The relationship between corrective and preventative maintenance
Performance improvement	<ul style="list-style-type: none"> • The key features of a typical performance orientated maintenance system

Unit 19: Brewing and the Environment

Topic	Candidates should understand and be able to demonstrate familiarity with:
Sustainability and climate change	<ul style="list-style-type: none">• The concept of a sustainable industry• The role of carbon dioxide – the carbon cycle• Sources of carbon dioxide emissions in brewing
Energy and water conservation	<ul style="list-style-type: none">• The principal energy consuming activities in a brewery• Typical energy reduction strategies• Principal water consuming activities• Typical water conservation strategies
Packaging waste	<ul style="list-style-type: none">• Strategies to minimise packaging material and encourage recycling