



Institute of Brewing & Distilling

**The Certificate in the Fundamentals of Brewing  
and Packaging of Beer (FBPB)**

**Syllabus**

**A qualification for the validation of the training in the basic technical knowledge of brewing and packaging of beer for production personnel or for the induction training of brewing company management recruits not necessarily intended for production management posts.**

## INTRODUCTION

The Certificate in the Fundamentals of Brewing and Packaging of Beer (FBPB) requires a basic knowledge of the processes used to produce and package the many types of beer consumed worldwide. The production of most beer types involves many common features and the purpose of this qualification is to provide a basic grounding in the technical features of brewing and packaging of beers for both brewery production personnel and for people employed in brewing companies (and related industries), but in non-technical roles.

The scope of the FBPB syllabus provides an introduction to the technology common to all aspects of beer production, but also allows candidates to select, in two syllabus sections, to study **either** the final processing and general packaging of chilled and filtered beers **or** specific details related to the production of cask-conditioned beers.

The format includes 17 common sections, plus 2 sections (final beer processing and beer packaging), in which candidates can elect to choose either the chilled/filtered beer (C&F) option or the cask beer (CSK) option.

It is anticipated that most candidates, especially those involved in company induction courses, will follow the C&F options, with the CASK options only appealing to candidates involved with production of traditional cask ales.

The examination will be based on a single 2 hour paper, comprising 50 Multiple Choice Questions based on all syllabus sections, but allows candidates the choice, where relevant, of answering C&F or CSK questions.

The full list of sections in the FBPB syllabus is:

1. Overview of Brewing and Packaging Practices
2. Brewing - Raw Materials for Sweet Wort Production
3. Brewing – the Conversion of the Starch to Sugars
4. Brewing – the Plant for Sweet Wort Production
5. Wort Boiling
6. Wort Clarification, Cooling and Oxygenation
7. The Basic Principles of Yeast Fermentation
8. Fermentation Practice
9. Beer Maturation and Storage
10. Processing Beer for Packaging
  - Either:** 10A (C&F): Processing Chilled/ Filtered Beer for Packaging
  - Or:** 10B (CSK): Processing Cask Beer for Racking
11. Beer Packaging – General Topics
12. Packaging of Beer
  - Either:** 12A(C&F): Packaging of Chilled/Filtered Beer – Specialist topics
  - Or:** 12B(CSK): Racking of Cask Beer – Specialist topics
13. Beer Quality - Process Control
14. Beer Quality – Flavour
15. Beer Quality – Microbiological Contamination
16. Beer Quality – Quality Management
17. Plant Cleaning
18. Engineering Maintenance
19. Brewing and the Environment

## Syllabus Section 1: An Overview of Brewing and Packaging Practices

### Summary of knowledge required for this section

- A. A general knowledge of the different styles of beer and their characteristics and the methods of brewing and presentation which differentiate them.
- B. A qualitative knowledge of the principal raw materials and process aids for brewing.
- C. A familiarity with principal stages of the brewing and packaging processes and a basic understanding of the technical terms used in brewing and packaging.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
1.1	General knowledge – beer types.	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, i.e. ales and other special top-fermented beers (e.g. Belgian beers), wheat beer, lager, stout, low-alcohol, low-carbohydrate. <sup>1</sup>
1.2	General knowledge – raw materials and processes for brewing.	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.
1.3	Definition of packaging.	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.

<sup>1</sup> Questions will not be asked about less well-defined marketing classifications such as 'lite' or 'ice-beer'.

## Syllabus section 2: Brewing - Raw Materials for Sweet Wort Production

### Summary of knowledge required for this section

- A. An appreciation of significance of barley as a source of carbohydrate and enzymes.
- B. An understanding of the basis of the malting process.
- C. An awareness of the types of malt and adjunct (other sources of carbohydrate) available, their significant differences and reasons for use.
- D. An appreciation of the importance of the water supply for brewing.

### The required learning outcomes

Syll. Ref.	Topics (Number of questions to be answered = 3)	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
2.1	Barley and malt	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).
2.2	Adjuncts and coloured malts	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.
2.3	Water	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).

### Syllabus section 3: Brewing – the Conversion of the Starch to Sugars

#### Summary of knowledge required for this section

- A. An understanding of the principal biochemical changes during mash conversion.
- B. An appreciation of the role of water (liquor) hardness salts in the mash.
- C. An awareness of the influence of wort characters on the final beer quality.

#### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
3.1	Mash conversion	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.
3.2	Sweet wort composition	The definition of extract. Composition of wort important for fermentation.

## Syllabus section 4: Brewing – the Plant for Sweet Wort Production

### Summary of knowledge required for this section

- A. Familiarity with the plant configuration of milling and mashing, conversion and wort separation systems.
- B. An awareness of the removal of spent grains as a co-product.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
4.1	Brewing plant – milling	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. <sup>2</sup> Health and safety aspects of malt handling and milling.
4.2	Brewing plant - mashing and conversion.	The operating principles and diagrammatic representation of typical mashing/mash conversion systems, including cereal cooker. The typical process times and temperatures used.
4.3	Brewing plant - wort separation.	The basic operating principles and diagrammatic representation of mash tuns, lauter tuns and mash filters. The significance of cycle times for brewhouse capacity. Use of spent grains as a co-product.

<sup>2</sup> Options include 6 –roll dry mill, wet mill, hammer mill. The malt preparation equipment, appropriate to the type of mill, includes screens, destoners, weighers and malt conditioning devices.

## Syllabus section 5: Wort Boiling

### Summary of knowledge required for this section

- A. Familiarity with the purpose of wort boiling and a qualitative understanding of the processes which occur during boiling.
- B. Familiarity with the operating principles of typical wort kettles (coppers) or wort boiling systems.
- C. An understanding of the role of hops.
- D. An awareness of the other raw material and process aid additions made to wort at the boiling stage.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
5.1	Wort boiling and boiling systems	The purposes of boiling <i>viz.</i> sterilization, stabilization of enzyme action, evaporation, coagulation and precipitation of protein (trub formation) and beer haze precursors, development of hop bitterness [see also ref. 5.2] 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).
5.2	Hop bitterness	The hop plant and hop growing regions of the world. Hop preparations. Isomerization 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.

## Syllabus section 6: Wort Clarification, Cooling and Oxygenation

### Summary of knowledge required for this section

- A. An understanding of the purposes and methods of wort clarification.
- B. Familiarity with the purposes and methods of wort cooling and oxygenation.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 1)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
6.1	Wort clarification	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.
6.2	Wort cooling and oxygenation	The effect of cooling on wort constituents. The purposes of wort cooling. Methods available for cooling wort. The purposes of wort oxygenation.

## Syllabus section 7: The Basic Principles of Yeast Fermentation

### Summary of knowledge required for this section

- A. Familiarity with the names, morphology and nutritional requirements of brewing yeasts.
- B. An appreciation of basic fermentation theory as applied to a brewery fermentation.
- C. An awareness of the influence of fermentation conditions and yeast handling on beer quality.

### The required learning outcomes

Syll. Ref.	Topics (Number of questions to be answered = 4)	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
7.1	Brewing yeast	<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.
7.2	Yeast Handling	Yeast propagation. Cropping and storage of yeast for re-pitching.
7.3	Fermentation theory	The main phases and events of a brewery fermentation including changes in yeast numbers and specific gravity, and levels of sugars and alcohol.
7.4	Fermentation and beer flavour.	The production of alcohol and carbon dioxide from wort sugars by yeast. <sup>3</sup> 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.

<sup>3</sup> Detailed knowledge of metabolic pathways and yeast enzymes is not required.

**Syllabus section 8: Fermentation Practice****Summary of knowledge required for this section**

- A. Familiarity with typical fermentation installations and an understanding of how fermentations are controlled.
- B. A familiarity with principles and reasons for brewing at high gravity and the practices for the dilution of high gravity beer to sales gravity.
- C. An appreciation of health and safety considerations in the fermentation area.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
8.1	Fermentation vessels and fermentation control	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.
8.2	High-gravity brewing	Reasons for brewing at high gravity and subsequent dilution.
8.3	Health and safety	The evolution of carbon dioxide from fermentations. The hazards associated with carbon dioxide and the observance of safety precautions.

## Syllabus section 9: Beer Maturation and Storage

### Summary of knowledge required for this section

- A. An understanding of the principles and practice of (warm) maturation, chilling and cold storage.
- B. An awareness of the care needed for the storage and movement of beer, especially with respect to dissolved oxygen and an awareness of the practices for the dilution of high gravity beer to sales gravity..

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
9.1	Maturation	<p>The purposes of warm maturation</p> <p>Typical times and temperatures for ales and lagers.</p> <p>Typical changes during maturation affecting beer flavour.</p> <p>The purposes of cold storage.</p> <p>Typical times and temperatures appropriate to different beer types.</p> <p>Additions made after maturation.</p> <p>The purposes of carbonation and typical dissolved CO<sub>2</sub> levels for different beer types.</p>
9.2	Storage, beer movement, dissolved oxygen and beer quality.	<p>The reasons for storage and storage times.</p> <p>Preservation of beer quality during storage and transfer to the packaging line.</p> <p>The vulnerability of beer to staling by oxygen.</p> <p>How oxygen stales beer.</p> <p>Sources of dissolved oxygen and the prevention of oxidation.</p> <p>The special requirements for the preparation of dilution water (liquor).</p>

**Syllabus Section 10: Processing Beer for Packaging****ONE OF THE FOLLOWING SECTIONS: 10A OR 10B****EITHER:****Syllabus section 10A(C&F): Processing Chilled/ Filtered Beer for Packaging****Summary of knowledge required for this section.**

- A. An understanding of the principles of beer chilling and clarification
- B. An understanding of the principles and practice of stabilization to prevent haze formation.
- C. An understanding of the principles and practice of beer filtration.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
10A.1 (C&F)	Clarification	Principles of sedimentation and centrifugation
10A.2 (C&F)	Haze stabilization	Haze precursors and their removal.
10A.3 (C&F)	Filtration	<p>The purposes of filtration.</p> <p>The principles of filtration – sieving, depth and absorption.</p> <p>The nature and preparation of filter aid – diatomaceous earth (kieselguhr) and perlite.</p> <p>The operating principles of rough beer filters, including cross-flow systems.</p> <p>The potential for filtration operations as sources of excessive effluent.</p> <p>The health and safety hazards associated with filter aids, the personal protection and the plant safety features necessary.</p>

**OR:**

**Syllabus section 10B(CSK): Processing Cask Beer for Racking**

**Summary of knowledge required for this section.**

- A. Knowledge of all aspects of the preparation of cask beer for racking.
- B. An understanding of the principles and practice of cask beer clarification.
- C. An understanding of the principles and practice of dry-hopping

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
10B.1 (CSK)	Preparation of Cask beer	The purposes of cask conditioning. The necessity of a controlled yeast concentration / count, typical values. Conditioning and the necessity for residual fermentable sugars. Reasons for the addition of priming sugar.
10B.2 (CSK)	Clarification	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.
10B.3 (CSK)	Dry hopping	Types of hops and hop preparations used for cask beer. Reasons for addition of hops or hop preparations.

## Syllabus section 11: Beer Packaging – General Topics

### Summary of knowledge required for this section

- A. Familiarity with the principal beer package types and an awareness of the factors influencing packaging line design.
- B. An understanding of how correct fill volumes are ensured.
- C. The importance of line capacity, efficiency reporting and an appreciation of loss control (both beer and packaging materials).
- D. An understanding of the purposes of package labelling, including bar coding.
- E. Familiarity with empty and full container inspection systems and the importance of recording data.
- F. An awareness of health and safety issues relating to packaging lines.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 6)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
11.1	Package types and packaging line design	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.
11.2	Package volume control	How package filling operations ensure correct fill volumes are achieved.
11.3	Line capacity, efficiency reporting and loss control	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.
11.4	Labelling and coding	The purposes of labeling and coding. Container areas (sites) for packaging coding. The reasons for bar coding. The importance of record keeping.
11.5	Container inspection	The purposes of empty and full container inspection. Checking the effectiveness of inspection and reject systems. The importance of record keeping.
11.6	Packaging line safety	Noise level control, ear protection. Guarding of machinery. Permit to work systems.

**Syllabus Section 12: Packaging of Beer****ONE OF THE FOLLOWING SECTIONS: 12A OR 12B****EITHER:****Syllabus section 12A(C&F): Packaging of Chilled/Filtered Beer – Specialist Topics****Summary of knowledge required for this section**

- A. An understanding of the principles and methods of beer pasteurization
- B. An awareness of the principles and methods of sterile filtration and filling.
- C. Familiarity with the characteristics of glass and plastic bottles.
- D. Familiarity with the characteristics of cans and kegs.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 4)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
12A.1 (C&F)	Pasteurization,	The purpose and principles of pasteurization. The pasteurization unit (PU). The principal features of plate (flash) and tunnel pasteurizers, the operational differences between them.
12A.2 (C&F)	Sterile Filtration and Sterile Filling	The reasons for sterile filtration as an alternative to pasteurization and the different line operations for tunnel pasteurization and sterile filling. Methods of achieving sterile filtration and their principles. The special installation requirements for sterile filling.
12A.3 (C&F)	Bottle design features	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.
12A.4 (C&F)	Can and Keg design features	The construction of metal cans and can ends and basic information of their manufacture. The construction of metal kegs and the extraction systems.

**OR:**

**Syllabus section 12B(CSK): Racking of Cask Beer – Specialist Topics**

**Summary of knowledge required for this section**

- A. An understanding of the principles of cleaning and filling of casks.
- B. An understanding of the control of additions at racking.
- C. Familiarity with all aspects of conditioning in cask.
- D. Familiarity with the principal features of cellar management.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 4)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
12B.1 (CSK)	Cask washing and racking	Preparation and inspection of casks for filling. Typical cask racking installations. Cask filling practice, typical temperature specification for beer at racking, fill volume control.
12B.2 (CSK)	Control of additions	Additions of finings at rack Dry hopping procedures.
12B.3 (CSK)	Conditioning in cask	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.
12B.4 (CSK)	Dispense	Cellar management. Dispense systems. Factors influencing product dispense life.

### Syllabus section 13: Beer Quality - Process Control

#### Summary of knowledge required for this section

- A. An understanding of the expression of beer quality as the realization of a specification to ensure product consistency.
- B. An understanding of process and product specifications and the key parameters for quality control.

#### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
13.1	Product consistency	<p>The variable nature of beer's natural ingredients.</p> <p>The influence of process parameters on final product parameters.</p> <p>The principles of monitoring and adjustment to achieve product consistency.</p> <p>The concept of 'trueness to type.'</p> <p>Simple statistical quality control procedures.</p>
13.2	Product and process specifications	<p>The purpose of a specification.</p> <p>The concepts of tolerance and range for specification parameter values.</p> <p>Typical specifications which differentiate beer types.</p> <p>Typical process specification ranges, especially those requiring periodic adjustment to achieve product consistency.</p> <p>The key quality parameters and their influence on beer quality.</p>

**Syllabus section 14: Beer Quality – Flavour****Summary of knowledge required for this section**

- A. Familiarity with the terminology for describing beer flavours.
- B. An appreciation of the methods of evaluating beer flavour.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
14.1	Terminology	The reasons for adopting industry standard descriptors for flavour. The flavour wheel. The more commonly used descriptors
14.2	Evaluation and tasting	Difference tests (e.g. the three-glass test). Flavour profiling. Trueness to type panel tasting. Taste training procedures.

**Syllabus topic 15: Beer Quality – Microbiological Contamination****Summary of knowledge required for this section**

- A. An appreciation of the vulnerability of wort and beer to microbiological contamination and the ways in which the product is spoiled.
- B. A basic knowledge of the principal groups of contaminating organisms found in a brewery.
- C. An awareness of how microbiological contamination can be detected.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
15.1	Beer spoilage	The substrates present in wort and beer to support microbial growth. Anaerobic growth. Common principal categories of spoilage organisms ( <i>viz. Lactobacillus, Acetobacter, wild yeasts sp.</i> ) and their effects on beer quality. The appropriate use of flavour descriptors to describe spoilage.
15.2	Detection and monitoring	Typical laboratory practices for the detection and identification of spoilage organisms.

## Syllabus section 16: Beer Quality – Quality Management

### Summary of knowledge required for this section

- A. Familiarity with the basic principles and benefits of a quality management system.
- B. An awareness of the organisational implications of a quality system.
- C. An understanding of product shelf life.

### The required learning outcomes

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
16.1	Describing a quality system; benefits, roles and responsibilities	<p>The key features of a quality system <i>viz.</i>:</p> <ul style="list-style-type: none"> <li>- written specifications</li> <li>- written procedures</li> <li>- document control</li> <li>- monitoring of performance</li> <li>- corrective actions</li> <li>- auditing</li> <li>- regular reviews for improvement.</li> </ul> <p>The business benefits of an effective quality management system. The impact of individual actions on product and service quality.</p>
16.2	Shelf life	<p>Factors affecting shelf life. Strategies to maximize unexpired shelf life at delivery to the retailer.</p>

**Syllabus section 17: Plant Cleaning****Summary of knowledge required for this section**

- A. An appreciation of the constituents and modes of action of detergents and sterilants.
- B. An appreciation of the practices for the safe handling of chemicals.
- C. The design and operating principles of in-place cleaning (CIP) systems
- D. The hygiene considerations of plant design

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 2)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
17.1	Detergents and sterilants and safety features.	The chemical nature of typical detergents and sterilants. The hazards associated with chemical cleaning and sterilizing agents. Good practices for the storage and handling of chemicals.
17.2	Cleaning-in-place (CIP) systems and hygiene factors of plant design	The operating principles and diagrammatic representation of typical CIP systems. Plant design - hygiene considerations.

**Syllabus section 18: Engineering Maintenance.****Summary of knowledge required for this section.**

- A. An appreciation of the reasons for the importance of an effective maintenance system.
- B. An appreciation of the systems or approaches available.
- C. An appreciation of performance orientated maintenance systems.

**The required learning outcomes**

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 1)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
18.1	Approaches and tasks	The business motives for an effective maintenance system. The relationship between corrective and preventative maintenance.
18.2	Performance improvement	The key features of a typical performance orientated maintenance system.

**Syllabus section 19: Brewing and the Environment****Summary of knowledge required for this section**

- A. An awareness of the impact of beer production on the environment.  
 B. An awareness of practices to reduce environmental impact

<b>Syll. Ref.</b>	<b>Topics</b> (Number of questions to be answered = 3)	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
19.1	Sustainability and climate change.	The concept of a sustainable industry. The role of carbon dioxide – the carbon cycle. Sources of carbon dioxide emissions in brewing.
19.2	Energy and Water conservation	The principal energy consuming activities in a brewery. Typical energy reduction strategies Principal water consuming activities. Typical water conservation strategies.
19.3	Packaging waste	Strategies to minimize packaging material and encourage recycling.

**END**