



Institute of Brewing & Distilling

The General Certificate in Packaging (GCP)

Examination Syllabus (May 2011)

This document details the course of study necessary to prepare for the examination for the GCP (Can, Keg, NRB and RB options). The specifications to which the respective examination papers are prepared are also shown.

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|  | Introduction. |
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The **General Certificate in Packaging** gives international recognition of a basic, underpinning knowledge and understanding in the principles of packaging operations.

The General Certificate examinations have been designed for candidates who may have little or no formal academic or technical qualification. Typically a candidate will be employed as a senior operator or team leader in a brewery or packaging plant, however the scope of these examinations will enable candidates from smaller brewing and packaging operations to obtain this recognised qualification. This examination is open to anybody with interest in brewing or beer packaging. They are a measure of basic knowledge (theoretical and practical) underpinning brewing, packaging and associated operations.

- The General Certificate in Packaging can be an end in itself, or the start of professional development, leading to the Diploma in Packaging (Dipl.Pack) and potentially, the Master Brewer (M.Brew) examinations.
- The General Certificate in Packaging has City & Guilds accreditation at Level 3 of the National Qualifications Framework in the UK (or equivalent internationally recognised standards),.
- The General Certificate in Packaging takes the form of one multiple choice paper of two hours.

Candidates can register to sit the exam on-line instead of using the traditional paper format. Candidates sitting within brewery or university centres will be encouraged to take the on-line version. The exam itself appears on the screen very much like the paper version and with the same number of questions, but there are various different ways of asking the questions which make the exam a more interesting experience. The marking is done electronically and candidates will receive a detailed feedback on how each section of the syllabus has been answered.

The pass mark is set at 66% (40 correct answers from 60 questions for GC exams. Candidates attaining 90% or more achieve a Distinction pass and 80 - 89% achieves a Credit pass.

GCP Syllabus (All Containers)

The full list of sections in the GCP syllabus is as follows:-

1. An overview of beer types and their packaging.
2. Bright beer production, storage and handling.
3. Beer pasteurization, sterile filtration and filling.
4. Specialist section –

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| Either | 4CAN | Cans and associated packaging materials. |
| or | 4KEG | Kegs and associated packaging materials. |
| or | 4NRB | Non returnable glass bottles and associated packaging materials. |
| or | 4RB | Returnable glass bottles and associated packaging materials. |
5. Specialist section –

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|---------------|------|---------------------------------|
| Either | 5CAN | The canning line. |
| or | 5KEG | The kegging line. |
| or | 5NRB | The non returnable bottle line. |
| or | 5RB | The returnable bottle line. |
6. Specialist section –

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| Either | 6CAN | Can inspection, plant and packaging materials preparation, and on-line checks. |
| or | 6KEG | Keg inspection, plant and packaging materials preparation, and on-line checks. |
| or | 6NRB | Bottle inspection, plant and packaging materials preparation, and on-line checks. |
| or | 6RB | Bottle washing and inspection, plant and packaging materials preparation, and on-line checks. |
7. Labelling and coding.
8. The measurement and reporting of packaging performance.
9. Warehousing.
10. Beer quality and process control for packaging.
11. Beer quality – Flavour.
12. Beer quality – Dissolved oxygen.
13. Beer quality – Contamination and microbiological infection.
14. Quality management.
15. Plant cleaning – Detergents and sterilizing agents.
16. Plant cleaning – Cleaning in-place (CIP) and general cleaning.
17. Engineering maintenance.
18. Utilities – Water and effluent in packaging.
19. Utilities – Process gases.
20. Packaging and the environment.

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|  | Syllabus Section 1: An overview of beer types and their packaging. |
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| Ref. | Topics (No. of questions to be answered = 2) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
|------|---|---|
| 1.1 | Definition of beer and types of beer | <ol style="list-style-type: none"> 1. A generic, non-legalistic definition of beer in terms of its typical ingredients and methods of production. 2. Characteristics which differentiate lagers, ales and stouts. |
| 1.2 | Definition of packaging Package types | <ol style="list-style-type: none"> 1. The definition of packaging in terms of its aims to meet the needs of customers, consumers, and typical regulatory requirements. 2. The concept of due diligence to ensure consumer safety. 3. A general knowledge of different types of packaging containers and their suitability to meet differing market conditions. |

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|  | Syllabus section 2: Bright beer production, storage and handling. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 2.1 | Bright beer filtration | <ol style="list-style-type: none"> 1. The purposes of beer filtration. 2. The basic principles of beer filtration. |
| 2.2 | Transfer of filtered beer and bright beer handling | <ol style="list-style-type: none"> 1. A working knowledge of the key operational procedures. 2. Basic design features of plant and pipe work (not cleaning). 3. Significance of atmospheric oxygen and the use of inert gases. [Also refer to syllabus sections 13 and 19.] 4. The essential plant items from the outlet of a filter to a bright beer tank and from the bright beer tank to a filling machine. [A representation as a flow diagram.] |
| 2.3 | Storage | <ol style="list-style-type: none"> 1. The purposes of storage (holding). 2. Equilibration and sampling. 3. Minimum and maximum residence times. 4. Beer blending procedures. 5. Calculations using beer blend parameters. |

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|  | Syllabus section 3: Beer pasteurization, sterile filtration and filling. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 3.1 | Pasteurization | <ol style="list-style-type: none"> 1. The function of pasteurization. 2. A description of pasteurization and the concept of pasteurization units (PU). 3. The significance of the presence of dissolved oxygen before pasteurization. [Also refer to syllabus section 13.] |
| 3.2 | Types of pasteurizers and their principal features | <ol style="list-style-type: none"> 1. The principal features of plate (flash) and tunnel pasteurizers. 2. The differences between tunnel and flash pasteurizers in the achievement of typical values. 3. The diagrammatic representation of the beer/container flows through the sections/zones of plate and tunnel pasteurizers, and their typical operating parameters. |
| 3.3 | Sterile filtration | <ol style="list-style-type: none"> 1. An awareness of different types of sterile filters and their operation. 2. The basic principles of sterile filtration. |

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|  | Syllabus section 4CAN: Specialist section - Cans and associated packaging materials. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 4.1 | Can design | <ol style="list-style-type: none"> 1. A detailed description of the principal characteristics of a can and its end - shape, dimensions, suitability for beer, special features, wear and tear. 2. A simple labelled diagram of a can, including the seamed end. |
| 4.2 | Can and associated packaging materials | <ol style="list-style-type: none"> 1. Materials of construction for cans and ends. 2. Typical sizes and the importance of dimensions. 3. Can decoration. 4. Types of associated packaging materials and their application. |

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|  | Syllabus section 4KEG: Specialist section - Kegs and associated packaging materials. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 4.1 | Keg design | <ol style="list-style-type: none"> 1. A description of the principal characteristics of a keg and extractor (spear) – shape, dimensions, suitability for beer, special features and wear and tear. 2. A simple labelled diagram of a sealed keg including details of the extractor (spear) and closure. |
| 4.2 | Keg materials of construction and associated packaging materials | <ol style="list-style-type: none"> 1. Materials of construction for kegs, extractor (spear) and their main characteristics. 2. The principal features of caps, labels, pallets, spacer boards/unitizers/locator boards. |

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|  | Syllabus section 4NRB: Specialist section - Non returnable glass bottles (NRB) and associated packaging materials. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 4.1 | NRB design | <ol style="list-style-type: none"> 1. A detailed description of the principal characteristics of a non-returnable bottle and its crown/closure - shape, dimensions, suitability for beer, special features, and wear and tear. 2. A simple labelled diagram of a NRB including the sealed crown/closure. |
| 4.2 | NRB and associated packaging materials | <ol style="list-style-type: none"> 1. Characteristics of bottles including colours. 2. Materials of construction for crowns/closures. 3. The importance of dimensions. 4. NRB permanent decoration. 5. Types of associated packaging materials and their application. |

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|  | Syllabus section 4RB: Specialist section - Returnable glass bottles (RB) and associated packaging materials. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 4.1 | RB design | <ol style="list-style-type: none"> 1. A detailed description of the principal characteristics of a returnable bottle and its crown/closure - shape, dimensions, suitability for beer, special features, and wear and tear. 2. A simple labelled diagram of a RB including the sealed crown/closure. |
| 4.2 | RB and associated packaging materials | <ol style="list-style-type: none"> 1. Characteristics of bottles including colours. 2. Materials of construction for crowns/closures. 3. The importance of dimensions. 4. RB permanent decoration. 5. Types of associated packaging materials and their application. |

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|  | Syllabus section 5 CAN: Specialist section – The canning line. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 5.1 | Principal plant items | <ol style="list-style-type: none"> 1. The function of individual plant items. 2. The key operational features of plant items. 3. The sequence of events for a canning line from empties handling to full products being discharged from the line. [A labelled flow diagram of a complete can line operation.] 4. Plant arrangement and compliance with health and safety requirements. |
| 5.2 | Can filling systems | <ol style="list-style-type: none"> 1. The principal operating features of can filling systems. 2. A simple diagram of a filler. 3. Sequence of events and processes during filling. 4. Can transfer and systems to prevent oxygen pick-up. |
| 5.3 | Control of filling levels | <ol style="list-style-type: none"> 1. The control of filling levels and the causes of over / under filling. 2. The use of a filling control chart system. 3. The reason for other filling faults and their causes. |
| 5.4 | Can seaming | <ol style="list-style-type: none"> 1. The principal operating features of a seamer. 2. A labelled diagram of a seamed can. 3. Methods to avoid oxygen pick up during seaming. |

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|  | Syllabus section 5 KEG: Specialist section – The keggling line. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 5.1 | Principal plant items | <ol style="list-style-type: none"> 1. The purposes of each plant item. 2. The key operational features of each plant item. 3. The sequence of events for a keggling line from empties handling to finished products being discharged from the line. [A labelled flow diagram of a complete keg line operation.] 4. The main stages of keg cleaning/sterilizing/filling. 5. Plant arrangement and compliance with health and safety requirements. |
| 5.2 | Internal keg cleaning / sterilizing | <ol style="list-style-type: none"> 1. The purposes of internal cleaning and sterilizing. 2. The principal operating features of internal keg cleaning/sterilizing systems. 3. A description of the normal sequence of events. 4. Times, temperatures, detergent strengths. 5. A diagrammatic representation of a keg being cleaned and sterilized. 6. Rejection of kegs and the reasons. |
| 5.3 | Keg filling systems | <ol style="list-style-type: none"> 1. The principal operating features of keg filling systems and how filling levels in the keg are controlled. 2. Causes of over or under filling. 3. The use of a filling control chart system. 4. A diagram of a keg being filled. |
| 5.4 | Heat sterilization | <ol style="list-style-type: none"> 1. Uses of steam and hot water as a sterilizing agent. [see 15.3] |

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|  | Syllabus section 5 NRB: Specialist section –The non-returnable glass bottling line. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 5.1 | Principal plant items | <ol style="list-style-type: none"> 1. The purposes of each plant item. 2. The key operational features of each plant item. 3. The sequence of events for a bottling line from empties handling to finished products being discharged from the line. [A labelled flow diagram of a complete NRB line operation.] 4. Plant arrangement and compliance with health and safety requirements. |
| 5.2 | Bottle filling systems | <ol style="list-style-type: none"> 1. The principal operating features of filling systems. 2. A simple diagram of filler. 3. Sequence of events and processes during filling. 4. The control of filling levels and the causes of over / under filling. 5. The use of a filling control chart system. 6. Full bottle transfer and systems to prevent oxygen pick up. 7. The reasons for other filling faults and their causes. |
| 5.3 | Bottle crowner and other closure methods | <ol style="list-style-type: none"> 1. The principal operating features of a crowner and crimping tolerances. 2. A simple labelled diagram of a crown closure. 3. Other methods of closing a bottle. 4. Methods to avoid oxygen pick up. |
| 5.4 | Sterile filling | <ol style="list-style-type: none"> 1. The special arrangements at the filler for sterile filling. |

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|  | Syllabus section 5 RB: Specialist section – The returnable glass bottling line. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
|------|---|--|
| 5.1 | Principal plant items | <ol style="list-style-type: none"> 1. The purposes of each plant item. 2. The key operational features of each plant item. 3. The sequence of events for a bottling line from empties handling to finished products being discharged from the line. [A labelled flow diagram of a complete RB line operation.] 4. Plant arrangement and compliance with health and safety requirements. |
| 5.2 | Bottle filling systems | <ol style="list-style-type: none"> 1. The principal operating features of a bottle washer with a quantitative knowledge of solution strengths and temperatures. 2. The principal operating features of filling systems. 3. A simple diagram of filler. 4. Sequence of events and processes during filling. 5. The control of filling levels, the causes of over / under filling. 6. The use of a filling control chart system. 7. Full bottle transfer, systems to prevent oxygen pick up. 8. The reasons for other filling faults and their causes. |
| 5.3 | Bottle crowner | <ol style="list-style-type: none"> 1. The purposes of crowning a bottle. 2. The principal operating features of a crowner. 3. Crimping. 4. Methods to avoid oxygen pick up. 5. A simple labelled diagram of a crown closure. |
| 5.4 | Sterile filling | <ol style="list-style-type: none"> 1. The special arrangements at the filler for sterile filling. |

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|  | Syllabus section 6 CAN: Specialist section – Can inspection, plant and packaging materials preparation, and on-line checks. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 6.1 | Preparation of plant and packaging materials. | <ol style="list-style-type: none"> 1. The concept of supplier quality assurance. 2. The procedures and checks carried out on a canning line before production (including utilities). 3. Incoming quality control, on-line checks and processes carried out on a can prior to filling. 4. Incoming quality control, on-line checks and processes carried out on associated packaging materials. 5. The procedures for size, beer type and package changes. |
| 6.2 | Empty can inspection and rinsing | <ol style="list-style-type: none"> 1. Empty can inspection. 2. The purposes and effectiveness of can rinsing. |
| 6.3 | Quality checks and record keeping | <ol style="list-style-type: none"> 1. The purpose of full can checks. 2. Finished pack inspection and common faults. 3. The purposes and importance of on-line checks during filling, sampling and record keeping. 4. Dealing with complaints. |

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|  | Syllabus section 6 KEG: Specialist section – Keg inspection, plant and packaging materials preparation, and on-line checks. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 6.1 | Preparation of plant and packaging materials. | <ol style="list-style-type: none"> 1. The concept of supplier quality assurance. 2. The procedures and checks carried out on a keg line before production (including utilities). 3. Incoming quality control, on-line checks and processes carried out on a keg prior to filling. 4. Incoming quality control, on-line checks and processes carried out on associated packaging materials. 5. The procedures for size and beer type changes. |
| 6.2 | Empty keg inspection and rinsing | <ol style="list-style-type: none"> 1. Empty keg inspection. 2. The purposes and effectiveness of keg cleaning and sterilizing. |
| 6.3 | Quality checks and record keeping | <ol style="list-style-type: none"> 1. The purpose of full keg checks 2. Finished keg inspection and common faults. 3. The purposes and importance of on-line checks during filling, sampling and record keeping. 4. Dealing with complaints. |

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|  | Syllabus section 6NRB: Specialist section – Bottle inspection, plant and packaging materials preparation, and on-line checks. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 6.1 | Preparation of plant and packaging materials. | <ol style="list-style-type: none"> 1. The concept of supplier quality assurance. 2. The procedures and checks carried out on a returnable bottle line before production (including utilities). 3. Incoming quality control, on-line checks and processes carried out on a bottle prior to filling. 4. Incoming quality control, on-line checks and processes carried out on associated packaging materials. 5. The procedures for size, beer type and package changes. |
| 6.2 | Empty bottle inspection and rinsing | <ol style="list-style-type: none"> 1. Empty bottle inspection. 2. The purposes and effectiveness of bottle rinsing. |
| 6.3 | Quality checks and record keeping | <ol style="list-style-type: none"> 1. The purpose of full bottle checks. 2. Finished pack inspection and common faults. 3. The purposes and importance of on-line checks during filling, sampling and record keeping. 4. Dealing with complaints. |

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|  | Syllabus section 6RB: Specialist section – Bottle washing and inspection, plant and packaging materials preparation, and on-line checks. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 6.1 | Preparation of plant and packaging materials. | <ol style="list-style-type: none"> 1. The concept of supplier quality assurance. 2. The procedures and checks carried out on a non returnable bottle line before production (including utilities). 3. Incoming quality control, on-line checks and processes carried out on a bottle prior to filling. 4. Incoming quality control, on-line checks and processes carried out on associated packaging materials. 5. The procedures for size, beer type and package changes. |
| 6.2 | Empty bottle inspection and washing | <ol style="list-style-type: none"> 1. Empty bottle inspection. 2. The purposes and effectiveness of bottle washing. |
| 6.3 | Quality checks and record keeping | <ol style="list-style-type: none"> 1. The purpose of full bottle checks. 2. Finished pack inspection and common faults. 3. The purposes and importance of on-line checks during filling, sampling and record keeping. 4. Dealing with complaints. |

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|  | Syllabus section 7: Labelling and coding. |
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| Ref. | Topics (No. of questions to be answered = 1) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 7.1 | Labelling and coding | <ol style="list-style-type: none"> 1. The purposes of labelling and batch/date coding. 2. The reasons for bar coding. 3. Locations on containers and final packages for coding information. 4. The importance of record keeping. |

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|  | Syllabus section 8: The measurement and reporting of line capacity and packaging performance. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 8.1 | Efficiency reporting | <ol style="list-style-type: none"> 1. The purposes of efficiency reporting. 2. Typical efficiency calculations and the analysis of data. [Candidates will be presented with data to carry out typical calculations of performance indicators.] 3. A description of a typical efficiency reporting system and its use for performance improvement. 4. Visual performance measurement (VPM). |
| 8.2 | The “V-curve” | <ol style="list-style-type: none"> 1. Line capacity rating conventions. 2. The basic principles of a “V- curve” applied to typical packaging lines. 3. Rate limiting factors and critical processes. 4. Machine cycle times and the reasons for maintaining a packaging line in balance. |
| 8.3 | Beer and packaging material losses | <ol style="list-style-type: none"> 1. The analysis of data and basic loss calculations. [Candidates will be presented with data to carry out typical loss calculations.] 2. The causes and control of beer and material losses. |

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|  | Syllabus section 9: Warehousing. |
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| Ref. | Topics <small>(No. of questions to be answered = 2)</small> | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 9.1 | Warehouse operations and best practices | <ol style="list-style-type: none"> 1. The purposes of a warehouse operation. 2. The handling of empty and full packages with forklift trucks or mechanical systems. 3. Reception and storage of packaging materials and pallets. 4. The reasons for stock rotation. 5. Working knowledge of a stock control system. 6. A quantitative knowledge of the environmental storage conditions for packaged beer and materials. |
| 9.2 | Health and safety | <ol style="list-style-type: none"> 1. The hazards associated with warehousing and typical safety procedures to help avoid them. 2. Typical housekeeping tasks. 3. The importance of pest control. 4. The importance of regular inspection checks for full and empty stock, pallets and packaging materials. 5. Operator duties for fork lift truck operation: <ul style="list-style-type: none"> - inspections at the beginning of a shift - basic FLT maintenance requirements |

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|  | Syllabus section 10: Beer quality and process control for packaging. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| | | <p><i>Key parameters examined in this section are:</i></p> <p><i>Original gravity (OG), present gravity (PG), alcohol content (ABV %), pH, colour, haze, head retention or foam stability, dissolved gases (oxygen, carbon dioxide, nitrogen)</i></p> |
| 10.1 | Key packaged beer parameters | <ol style="list-style-type: none"> 1. The significance of these key parameters (including their units of measure) for monitoring beer quality. 2. Factors which can affect the values of these key parameters during packaging. |
| 10.2 | Process specifications | <ol style="list-style-type: none"> 1. The purpose of process specifications. 2. The influence of packaging processes on final package parameters. |
| 10.3 | Process control | <ol style="list-style-type: none"> 1. The principles of monitoring and adjustment to achieve product consistency of in-package and final pack (secondary and tertiary) specification. 2. Pre-package tasting. 3. Statistical quality control charts. 4. Typical applications for in-line and on-line instruments for process control. |

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|  | Syllabus section 11: Beer quality – Flavour. |
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| Ref. | Topics (No. of questions to be answered = 2) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 11.1 | Terminology | <ol style="list-style-type: none"> 1. The reasons for adopting industry standard descriptors for flavour. 2. The flavour wheel. 3. The more commonly used components. 4. Taste training procedures. |
| 11.2 | Evaluation and tasting during processing | <ol style="list-style-type: none"> 1. The three-glass test – statistical significance rating. 2. Flavour profiling. 3. Trueness to type panel tasting. 4. Common faults / contamination by contact materials that may be detected by tasting during packaging operations. |

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|  | Syllabus section 12: Beer quality – Dissolved oxygen. |
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| Ref. | Topics <small>(No. of questions to be answered = 4)</small> | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 12.1 | Flavour deterioration by oxygen | <ol style="list-style-type: none"> 1. Sensitivity of beer to small amounts of oxygen. 2. Flavour stability and beer freshness. |
| 12.2 | Sources of oxygen | <ol style="list-style-type: none"> 1. Oxygen as a constituent of air. 2. Potential points of exposure of beer to air. |
| 12.3 | Monitoring of oxygen levels | <ol style="list-style-type: none"> 1. Key control points, significance of sampling time. 2. Total in-package oxygen (TIPO) measurement. |
| 12.4 | Control of dissolved oxygen levels | <ol style="list-style-type: none"> 1. Best practice maximum levels. 2. Techniques to avoid oxygen pick-up. |

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|  | Syllabus section 13: Beer quality – Contamination and microbiological infection. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 13.1 | Non-microbiological contamination | 1. Sources of contamination from: <ul style="list-style-type: none"> - empty containers and closures - conveying systems for small packages - plant cleaning - oil and grease - water and the atmosphere |
| 13.2 | Microbiological contamination and spoilage organisms | 1. The principal categories of spoilage organisms: <i>Pediococcus</i> , <i>Lactobacillus</i> , <i>Megasphaera</i> , wild yeasts: <ul style="list-style-type: none"> - potential points of contamination in bright beer or container - their respective characteristic effects on beer in package |
| 13.3 | Other organisms indicative of contamination | 1. Water-borne coliform (<i>Escherichia</i> , <i>Enterobacter</i>): <ul style="list-style-type: none"> - the implications of their presence |
| 13.4 | Detection, monitoring and control | 1. Methods of sampling for microbiological testing. 2. Key sampling points. 3. Laboratory detection methods. 4. Routine practices to protect against infection. 5. Special measures to eliminate on-going sources of infection. |

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|  | Syllabus section 14: Quality management. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 14.1 | Features of a quality system | 1. The key features of a quality system: <ul style="list-style-type: none"> - written specifications - written procedures - monitoring of performance - corrective actions - auditing - regular reviews for improvement |
| 14.2 | Roles responsibilities and benefits | 1. The impact of individual actions on product and service quality. 2. The control of documentation. 3. The maintenance of conformity. 4. The business benefits of an effective quality management system. |
| 14.3 | Product safety | 1. The control of product safety <ul style="list-style-type: none"> - Hazard analysis and critical control points (HACCP). 2. The importance of traceability for product recall. |

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|  | Syllabus topic 15: Plant cleaning – Detergents and sterilizing agents. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 15.1 | Detergents | <ol style="list-style-type: none"> 1. Types of detergent (alkali, acid and neutral). 2. The constituents of detergents. 3. The individual functions of the constituents. 4. Criteria for choice of detergent for an application. 5. Considerations for the use of hot detergent cleaning. |
| 15.2 | Sterilants | <ol style="list-style-type: none"> 1. Types of sterilant as defined by the active agent. 2. Criteria for choice of sterilant for an application. 3. The effect of sterilant residues on beer quality. |
| 15.3 | Heat sterilization | <ol style="list-style-type: none"> 1. Uses of steam and hot water as a sterilant. 2. Time and temperature. |
| 15.4 | Safety | <ol style="list-style-type: none"> 1. The hazards associated with chemical cleaning and sterilizing agents. 2. Good practices for the storage of chemicals. 3. Use of personal protective equipment (PPE). 4. Procedures in case of accidental spillage or discharge of chemicals. |

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|  | Syllabus section 16: Plant cleaning - Cleaning in-place (CIP) and general cleaning. |
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| Ref. | Topics (No. of questions to be answered = 4) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 16.1 | Types of CIP systems | <ol style="list-style-type: none"> 1. The general differences between single use and recovery systems – advantages and disadvantages. 2. The types of cleaning head used and reasons for their choice. 3. The operating principles and diagrammatic representation of CIP systems. |
| 16.2 | CIP cleaning cycles | <ol style="list-style-type: none"> 1. Typical cleaning programs and cycle times. 2. The function of each of the cleaning cycle stages. 3. Quality assurance of cleaning operations. |
| 16.3 | CIP plant design hygiene considerations | <ol style="list-style-type: none"> 1. Design features that minimize soil accumulation in brewery vessels and pipelines. 2. Design features that facilitate vessel and pipeline cleaning using a CIP system. 3. Design features which promote a hygienic working environment. |
| 16.4 | General plant cleaning | <ol style="list-style-type: none"> 1. Cleaning plant surfaces, walls and floors. 2. The constituents of foam cleaning agents. 3. The use of foaming systems. |

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|  | Syllabus section 17: Engineering maintenance. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 17.1 | Objectives and approaches | <ol style="list-style-type: none"> 1. The key business reasons for an effective maintenance system. 2. The features, advantages, disadvantages and applications of: <ul style="list-style-type: none"> - no maintenance - breakdown maintenance - preventive maintenance - predictive maintenance 3. The contribution of maintenance tasks to plant safety, reliability, quality, economics and environmental impact. |
| 17.2 | Maintenance tasks | <ol style="list-style-type: none"> 1. Familiarity with key maintenance tasks: <ul style="list-style-type: none"> - mechanical - electrical - calibration - inspection - condition monitoring - cleaning of plant - health and safety 2. Maintenance planning and record keeping. 3. Autonomous maintenance. |
| 17.3 | Systems for continuous improvement | <ol style="list-style-type: none"> 1. The key features of the following performance improvement systems: <ul style="list-style-type: none"> - Reliability Centred Maintenance (RCM) - Total Productive Maintenance (TPM) - Workplace Organisation (5S) |

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|  | Syllabus section 18: Utilities – Water and effluent in packaging. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 18.1 | Water treatments | 1. The basic principles and diagrammatic representation treatment plants for: <ul style="list-style-type: none"> - water filtration - water sterilization - water softening / deionization - water de-aeration |
| 18.2 | Water types and uses | 1. Differentiation and typical uses of: <ul style="list-style-type: none"> - de-aerated water - process water - service water 2. <i>Legionella</i> in cooling water and service water and the health risks associated with the organism. 3. Points at which water is introduced into the process and the special water quality needed at these points. |
| 18.3 | Sources of effluent and its measurement | 1. The nature and characteristics of effluent from principal packaging and bright beer room sources. 2. The components of effluent quality: <ul style="list-style-type: none"> - volume - suspended solids (SS) - chemical oxygen demand (COD) - biological oxygen demand (BOD) - pH - temperature |

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|  | Syllabus Section 19: Utilities – Process gases. |
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| Ref. | Topics (No. of questions to be answered = 2) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 19.1 | Properties and applications | <ol style="list-style-type: none"> 1. The essential properties and quality of compressed air for use as a process gas. 2. The essential properties of carbon dioxide and nitrogen for use as process gases. 3. The significance of inertness. 4. Typical uses for process gases. 5. The economic importance of leak prevention. |
| 19.2 | Health and Safety Issues | <ol style="list-style-type: none"> 1. Safe entry into tanks, cold rooms and other confined spaces. 2. Safe handling and storage of compressed gas cylinders. 3. Safety hazards associated with storage of liquid gases and their distribution in high-pressure mains. |

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|  | Syllabus section 20: Packaging and the environment. |
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| Ref. | Topics (No. of questions to be answered = 3) | Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with: |
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| 20.1 | Sustainability and climate change | <ol style="list-style-type: none"> 1. The concept of a sustainable industry. 2. The role of carbon dioxide. 3. Sources of carbon dioxide emissions. |
| 20.2 | Conservation | <ol style="list-style-type: none"> 1. The principal energy consuming activities on a packaging line. 2. Typical energy reduction strategies. 3. Principal water consuming activities. 4. Typical water conservation strategies. |
| 20.3 | Packaging waste | <ol style="list-style-type: none"> 1. Waste generating activities and issues for disposal. 2. Strategies to minimize packaging material and encourage recycling. 3. The impact of packaging waste on household (consumer) recycling. |