

Module Title:	Malt, Water, Hops and Yeast – Brewing and Distilling Raw Materials
Language of Instruction:	English
Credits:	10
NFQ Level:	6
Module Delivered In	1 programme(s)
Teaching & Learning Strategies:	<p>In this level 6 module, the learning objectives, learning activities and assessments are constructively aligned. A variety of active learning strategies, facilitated by the VLE, Blackboard, will be employed: eg lectures, practical's, discussion, site visits, engagement with materials (texts, journals etc.) industry practice materials (case studies, live case examples, industry reports etc.). Learners will be expected to actively engage with module materials (online & offline) and with associated in class and out of class activities. Where appropriate a flipped classroom approach will be used to maximise classroom interaction. The active use of the VLE Blackboard will enhance digital competencies, aid in formative assessment and a provide blended learning approach well as providing a resource repository. Independent learning and reflection will be developed by use of scaffolding in class and supported research and enquiry activities. Research and enquiry skills will be developed in a supported manner via activities that will involve the learner finding, evaluating and organising information from credible sources, analysis and synthesis of new information and communicating new knowledge in the correct discipline appropriate convention. These independent learning activities will also encourage digital literacy, development of communication skills and group and peer learning as appropriate. The practical component, as well as the development of skill mastery, will support the theoretical aspects of the module and promote deep learning via, the formulation of simple hypotheses, structured investigation of simple problems and application of prior knowledge. In addition, practical's will allow students to develop the required safe technical competencies, attitudes and behaviours required. This module has no terminal exam but is assessed summatively via a continuous assessment a practical and an integrated capstone project component. Assessment both formative and summative with associated feedback, both digital (via Blackboard / Turnitin) and face to face will be used to motivate, check knowledge as well as assess the attainment of learning outcomes. Strategies will be used to ensure that feedback is attended to and to avoid over assessment. Cross assessment with Microbiology will occur. A mix of digital and conventional assessment methods eg MCQ, short answer, video poster, presentation, assignment, reports will be used. Assessment of the practical component that encourages not only the development of key practical and reporting competencies, but also critical thinking, analysis and group learning will be used via digital and conventional means as appropriate. Integration of learning outcomes will be assessed by a capstone project as well as the practical assessment.</p>
Module Aim:	The aim of this module is to allow learners to understand how raw materials including yeast affects the brewing and distilling process and the finished products.
Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Describe the relevant phenotypic and genotypic characteristics of brewing yeasts.
LO2	Describe yeast growth, propagation and the fermentation cycle and explain controlling factors relevant to brewing and distilling.
LO3	Explain the relevance of yeast metabolism and explain the factors that affect alcohol, biomass and flavour production.
LO4	Relate the structure, morphology, and growth of barley grains to the production of quality malting barley.
LO5	Describe the technical and biochemical principles of malt production and brewing enzymes, along with the production and impact of water and hops in the brewing and distilling industry.
LO6	With due regard to health and safety and cGLP, develop brewery relevant practical, recording, reporting skills, in grain & malt analyses, yeast analysis, propagation, handling and storage. Integrate theory to contextualise, and analyse data obtained.
Pre-requisite learning	
Module Recommendations	
<i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements	
<i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Brewing Yeast

Yeast classification, Yeast cell structure, budding, Characteristics of brewing yeasts. Flocculation and attenuation. Differences between lager and ale yeasts. Yeast strains. Non-Saccharomyces brewing yeast. Relevance of the polyploid yeast genome. Mutations relevant to the Brewer / Distiller. Characterisation and typing yeast strains. Molecular typing methods. Generation of new strains.

Yeast handling

Factors affecting yeast growth during propagation and fermentation. Yeast propagation from pure cultures. Importance of pitching rate viability, vitality. Fermentation cycle. Methods for cropping and yeast storage.

Fermentation: alcohol production and flavour

Aerobic and anerobic metabolism, alcoholic fermentation. Control of fermentation, Pasteur Effect, Crabtree effect. Importance of Wort; Carbohydrate and Nitrogen uptake. Factors affecting alcohol production. Factors controlling the production of desirable compounds, alcohols, esters, carbonyl and undesirable flavours.

Barley and Malting

Composition, growth and development. Barley selection, requirements for malting. The malting process including the physiological changes during malting. Biochemistry of barley germination: endosperm, starch, proteins, fats, phosphates etc. Dormancy/viability. Gibberellic acid. Enzyme activity. The chemistry of kilning. Malt Quality and Brewhouse Performance. Extraction prediction. The use of malt outside of brewing/distilling.

Water

Water quality in brewing; water hardness and ion composition. Water treatment: softening and deionization; calcium and bicarbonate ions. Chemical and microbial contamination of water. Water in cleaning, sterilizing, cooling and heating. Steam generation. Heat exchangers. Effluent treatment, waste valorisation.

Hops

Growing, Selection, diseases, harvesting and drying. Hop products, chemistry of hop constituents (acids and aroma), hop flavour stability. Chemistry of hop boiling, hop utilisation, isomerised hop extract. Hop acids and aroma.

Introduction to packaging types and technologies

Introduction to the different types of packaging and their functions. Function of a label and label information.

Site Visit(s)

Visit to a Malting Plant, Brewery, Distillery

Practicals

Integrated practicals complementing both aspects of the module will occur. Cross module assessment with Microbiology will occur. Suggested practicals. 1. Macroscopic and microscopic observation of brewing and other yeast 2. Aseptic cultivation and handling and storage of yeasts on solid and liquid media. 3. Direct and indirect enumeration. 4. Isolation and characterisation of new and standard brewing yeasts. 5. Spoilage, sanitation, monitoring and control. 6. Propagation, pitching, fermentation and cropping in Lab-scale beer fermentation. 7. Post-fermentation beer processing – clarification, centrifugation and maturation. 8. Yeast flocculation – the effect of ions and water type. 9. Comparison of brewing yeast strains – flavour production by yeast. 10. Moisture content of barley/malt. 11. Protein content. 12. Enzyme Activity. 13. Grain viability/capacity/energy/dormancy. 14. Friability. 15. Mycotoxin analysis. 16. Extract estimation.

Assessment Breakdown	%
Continuous Assessment	25.00%
Project	25.00%
Practical	50.00%

Special Regulation

Students must achieve a minimum grade (35%) in all practical/CA/Project components. IT Carlow reserves the right to alter the nature and timings of assessments

Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Other	A mix of appropriate formative and summative assessment accompanied by feedback as appropriate eg MCQ, Short answer questions, oral, short assignment/ Site visit report. In class activities. Group and peer learning.	1,2,3,4,5,6	25.00	n/a

Project

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Project	Project (10%): Frame a question based on raw materials. Scope and plan the project. Find and organize information from credible sources/ practical data obtained. Written Report/ Poster /Presentation (10%): Preparation of report/ Poster. Reflection on learning. Performance Evaluation (5%): Oral defence to peers and others.	1,2,3,4,5,6	25.00	n/a

Practical				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Practical/Skills Evaluation	Strategies will be used for the assessment of the practical component that encourage not only the development of key practical and reporting competencies but also the appropriate scientific thinking, research and enquiry, reflection, analysis, group learning and communication skills will be used via electronic and conventional means as appropriate. The use of prepractical assessment will encourage engagement.	1,2,3,4,5,6	50.00	n/a

No End of Module Formal Examination

Continuous Assessment				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Examination	MCQ, Short Paragraphs, Verbal Assessments	1,2,3,4,5,6	25.00	n/a

Project				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Project	Data from lecture material, independent learning, site visits, practicals and assignments can be used to produce a project in a group or single setting at the end of the module.	1,2,3,4,5,6	25.00	n/a

Practical				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Practical/Skills Evaluation	Laboratory write up/ assignments where theory is applied to practical/ video assessment	1,2,3,4,5,6	50.00	n/a

No End of Module Formal Examination

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
Workload Type	Frequency	Average Weekly Learner Workload
Lecture	12 Weeks per Stage	6.00
Practicals	12 Weeks per Stage	4.00
Independent Learning	15 Weeks per Stage	8.67
Total Hours		250.00

Workload: Part Time		
Workload Type	Frequency	Average Weekly Learner Workload
Laboratory	15 Weeks per Stage	3.00
Independent Learning	15 Weeks per Stage	3.67
Total Hours		100.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_SABRE_B	Bachelor of Science (Honours) in Brewing and Distilling	4	Mandatory