

## Appendix E Mapping of Program Learning Outcomes to Course Learning Outcomes

PROGRAM COURSES AND THEIR CLOs	PROGRAM LEARNING OUTCOMES				
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5
	1. Demonstrate and evaluate safe work practices based on hazard analysis.	2. Demonstrate the fundamental techniques of beer production.	3. Apply knowledge of beer chemistry and microbiology in brewery operations	4. Evaluate appropriate process technology practices in brewery operations.	5. Evaluate and control the consistency and quality of beer using chemical, microbiologic al and sensory analysis
	6. F his evc the ind tod ma sty reg				
<b>HOPS 1100: Introduction to Brewing</b>					
Describe the processing and role of the major ingredients in the brewing process					
Explain the major processes involved in beer production from grain to package					
Discuss the history of brewing					
Describe how the development of technologies, beer styles, regulations, and entrepreneurs have influenced each other to form the current state of the brewing industry					
Explain the impact of beer on the human body					
<b>HOPS 1105: Brewing 1</b>					
Employ safe work practices					
Identify all components of brewing equipment					
Choose appropriate brewing ingredients					
Operate brewing equipment correctly					
Clean and sanitize brewing equipment					
Describe proper storage of brewing supplies and raw materials					
Describe basic brewing procedures					
Make beer starting from the raw ingredients					
Maintain brewing equipment					

Perform basic brewing measurements						I				I	
Produce and interpret basic brewing graphs											I
<b>HOPS 1110: Sensory Eval &amp; Ingredients</b>											
Explain how humans experience and process sensory information											I
Utilize the Standard International Beer Flavor terminology and the Beer Flavor Wheel to describe beer flavor and sensory attributes											I
Identify and recognize common beer attributes and defects											I
Describe the influence of brewing ingredients and processes on the flavor of the beer					I						I
Apply basic sensory panel tests to meet different goals											I
<b>HOPS 1205: Brewing 2</b>											
Explain health and safety measures to ensure safe working conditions in a brewery			D								
Describe a Hazard Analysis Critical Control Plan (HACCP)											I
Select brewing ingredients based on product requirements				D							
Source brewing supplies and raw materials				D							
Operate brewing equipment				D					D		
Clean and sanitize brewing equipment				D					D		
Explain brewing procedures					D						
Make beer using low gravity and high gravity techniques					D						
Prepare and interpret wort and beer samples						D					D
Produce and interpret graphs used in brewing											D
Estimate production costs						I					
<b>HOPS 1211: Brewing Microbiology</b>											
Describe the importance of yeast strain and culture purity						D				D	
Discuss the major factors of yeast performance and how to utilize these to impact finished beer flavor and operational results						D			D	D	D
Optimize a brewery fermentation profile to meet various competing output requirements (flavor, alcohol production, tank utilization, energy costs)						D			D	D	D
Perform basic microbiological testing			D			D			D	D	D

Identify common beer spoilage organisms						D		D
Create a brewery microbiological sampling plan		D				D	D	D
Show basic microbiological problem solving techniques						D		D
<b>HOPS 1212: Brewing Chemistry</b>								
Explain basic chemistry fundamentals							D	
Solve a variety of stoichiometric, thermodynamic and gas law problems							D	
Recognize the variety of organic compounds contained in beer							D	
Explain the chemical properties of brewing ingredients and how they influence wort and beer production							D	
Describe pH and its effects on wort and beer production							D	
Explain the chemistry of brewing, fermentation and post-fermentation processes							D	
Describe the isomerization of organic compounds found in beer							D	
Explain and apply the chemistry of brewery cleaning and sanitation processes							D	
Describe and apply basic principles of quality management and process control to wort and beer production							I	
Explain and apply the laboratory concepts and techniques used to assess and control the chemical properties of wort and beer	I				I			I
<b>HOPS 1213: Brewing Equipment &amp; Technology</b>								
Explain the technological requirements and equipment choices for the brewing process stages	I				I			
Describe the safety, quality, food production requirements, and environmental and efficiency factors for the brewing process stages								I
Recognize the importance of brewery utilities throughout the process								I
Apply basic pump theory to selection of pump types for various process stages					I			I
Describe the basics of process control and automation and the process sensors available for the brewing process								I
<b>HOPS 1214: Intro to Finishing</b>								
Explain basic filtration theory								I
Identify different types of filters								I
Explain the basic principles of counter-pressure filling of carbonated beverages					D			





<b>HOPS 2315: Calculations and Recipe Form</b>					
Develop a capacity plan for a brewery					I
Calculate ingredient quantities for a given brew length					D
Convert between different units of measurement used in breweries					A
Calculate brewhouse yield, alcohol content, and grain and hop utilization					A
Develop beer recipes					A
Evaluate production losses and formulate improvements					I
Calculate energy requirements for a brewery					I
Calculate the quantities of raw ingredients and cleaning supplies needed for effective management of a brewery					D
Calculate water usage, fermentation losses, and carbon dioxide emissions					D
Calculate staffing requirements for a brewery					I
<b>HOPS 2405: Brewing 4</b>					
Create health and safety procedures for a brewery		D			
Develop a beer recipe			A		
Formulate a cost analysis for the production of a beer			A		
Design a brewing schedule					
Evaluate and order brewing ingredients to produce a signature beer			D		
Clean and sanitize brewing equipment independently			A		
Order and propagate yeast for a signature beer				D	
Make beer from the raw ingredients and finish with a packaged product			A		
Produce a beer that passes organoleptic evaluation from an external panel of experts					D
Create and implement a testing and analysis schedule for a beer					A
Perform product analysis					A
Operate, maintain and troubleshoot brewing equipment					
Organize a tasting panel for the evaluation of a beer					D
Market a signature beer					
Maintain a comprehensive lab log book					
					A
<b>HOPS 2420: Beer Marketing &amp; Sales</b>					

Explain the regulatory requirements and responsibilities for beer sales and manage these effectively in sales and marketing plans	I					
Create an effective beer brand marketing and sales plan						
Consider the current organizational priorities and financial planning in developing a sales department						
Plan an effective sales call format and schedule						
<b>HOPS 2421: Brewery Business Planning</b>						
Recognize the primary responsibilities of brewery operations management	D	D	D	D	D	D
Explain the factors that must be considered in optimizing brewery scheduling			D			
Calculate a brewery's capacity utilization and consider the implications for sales growth			I			D
Validate the requirements for accurate and timely record-keeping						
Explain the relationship of long term strategic planning, annual operational plans, financial budgeting, and business performance management						
Contrast the roles of management and leadership						
Apply management and team skills						
<b>HOPS 2422: The Brewing Industry</b>						
Discuss the involvement and impact of government regulations on the brewing industry	I					
Analyze the impact of the brewing industry on the economy and the community						
Examine various professional and industry organizations and their contribution to the beer industry						
Compare the various distribution systems utilized by the brewing industry						
Devise effective plans for stakeholder engagement						
<b>CMNS 1140: Intro to Professional Communication</b>						
Understand the basic communication models						
Identify the differences between academic and business writing						
Establish purpose and determine message content, medium and delivery strategy through context and audience analysis						

Adapt message and medium and purpose to a single audience and context, in both traditional and online environments							
Compose the message for the appropriate medium, including online environments							
Write to primary and secondary audiences							
Communicate with diverse audiences							
Demonstrate the ability to write clearly and concisely for the workplace using correct grammar, mechanics and syntax							
Demonstrate understanding of appropriate business communication terminology							
Employ fundamental principles of document design and business document conventions to produce a variety of correspondence and reports							
Integrate clear, concise, grammatically-correct language with visual design components							
Illustrate information using a variety of integrated figures and tables							
Research data from primary and secondary sources, and evaluate that data for relevance and accuracy before integrating it with appropriate citations into documents							
Extract, synthesize and summarize essential information from both written and oral sources							
Apply informative and persuasive strategies using direct and indirect approaches to achieve precisely defined goals							
Develop and deliver oral presentations to an audience, within a variety of contexts							
<b>CBSY 1110: Business Problem Solving with S/S</b>							
Understand business problems and the need for data to address them							
Develop spreadsheets to gather data about business problems							
Employ functions and calculations available on spreadsheet software to analyze business data							
Create charts and analyze them to support business problem solving							



Integrate spreadsheet-based analysis into the effective solutions to business problems													
<b>PHIL 3033: Business Ethics</b>													
Defend an ethical position in a rational way													
Apply ethical theories to standard business practices													
Recognize the moral component of complex business decision-making													
Critically analyze business outcomes from a moral point of view													
Articulate the moral dimension of business decisions with respect to each of three theoretical approaches: the moral consequences of the decision, the relevant duties of the participants, and the fairness of the result													
Recognize several Canadian (and International) business scenarios, which illustrate the application of these methods													

**Introduced [I]:** Course learning outcomes that concentrate on knowledge or skills related to the program outcomes at a basic level or skills at an entry-level of complexity.

**Developing [D]:** Course level outcomes that demonstrate learning at an increasing level of proficiency of the program level outcome as well as expanding complexity.

**Advanced [A]:** Course level outcomes that demonstrate learning related to the program level outcome with an increasing level of independence, expertise and sophistication or integrate the use of content or skills in multiple levels of complexity.