

Certificate of Proficiency in Brewing Science (BREWCP)

This program is designed to provide students with a theoretical and practical introduction to brewing and fermentation. This certificate requires 15 credit hours of coursework, selected from the list below.

REQUIRED COURSES – 9 hours

___ FDSC 2723 Introduction to Brewing Science

___ BIOL 2723L Microbial Fermentation Laboratory

___ Required internship, special problems, or honors research project – 3 hours course credit

Internship: Students could participate in an approved three credit hour internship with a brewing industry partner. The internship should involve approximately 120-130 hours of work with the industry partner. The internship work can be completed in one semester or over multiple semester with enrollment during the final semester. At the end of the final semester of the internship, students would have to present a written and oral report of the work performed and lessons learned.

Special problems or research hours: Students could complete three credit hours working on a practical research problem under the supervision of a faculty member in FDSC, BISC, CHEM, BENG or CHEG. The topic of this work should be approved for relevance to the certificate before the work begins and reviewed if it changes substantially during the course of the work. Work that involves industry partners is particularly encouraged. At the end of the final semester of the work, students would have to present a written and oral report of the work performed and lessons learned. Credit hours and work done for an honors degree can satisfy this requirement, but if honors work is used, it must include at least one credit hour in three different semesters.

ELECTIVE COURSES – 6 hours

Select at least two courses from the list below. To broaden the student's exposure to the skills needed in brewing and fermentation, for currently enrolled undergraduate students, at least one of these courses must be in a different department from the department of the student's major, and that course must also be outside of those already required for the student's major(s). If the student already holds a degree, the course must be a new one outside of the previous degree program.

Courses to choose from:

___ BIOL 2013 General Microbiology *OR* BIOL 3123 Prokaryote Biology

___ BIOL 2533 Cell Biology *OR* BIOL 2323 General Genetics

___ CHEM 2613 Organic Physiological Chemistry *OR* CHEM 3613 Organic Chemistry II

___ FDSC 3103 Principles of Food Processing

___ FDSC 2603 Science in the Kitchen

___ FDSC 2523 Sanitation and Safety in Food Processing Operations

___ FDSC 4122 Food Microbiology

___ CHEG 2133 Fluid Mechanics

___ CHEG 3144 Heat and Mass Transfer

___ BENG 3113 Measurement and Control for Biological Systems

___ BENG 3733 Transport Phenomena in Biological Systems

Course Descriptions and Pre-requisites

FDSC 2723 Introduction to Brewing Science (Typically offered: Fall)

An introduction to the biology and chemistry of fermentation, with an emphasis on beer brewing. Styles, flavors, and quality characteristics of beer will be discussed. The history, legal aspects, and economic impacts of homebrewing as well as craft and industrial brewing will be covered. Coursework is expected to integrate lectures and guest presenters with supplemental reading assignments. This course will not include beer tasting, therefore there are no age restrictions for enrollment. Prerequisite: (CHEM 1123 or CHEM 1073) and BIOL 1543.

BIOL 2723L Microbial Fermentation Laboratory (Typically offered: Fall)

An inquiry-based introductory lab course that explores the biology and chemistry of brewing, with a focus on brewing microbiology. Laboratory 6 hours per week. Students must be 21 years of age or older on the first day of class. Prerequisite: BIOL 1543 or BIOL 1584. Pre- or Corequisite: FDSC 2723.

BIOL 2013 General Microbiology (Typically offered: Fall, Spring and Summer)

Basic concepts of microbiology including diversity, genetics, metabolism, growth, control of growth, pathogenesis, and immunology. Does not count towards BS in Biology. Corequisite: BIOL 2011L. Prerequisite: (BIOL 1543 and BIOL 1541L or BIOL 1584) and (CHEM 1073 and CHEM 1071L or CHEM 1103 or CHEM 1123 and CHEM 1121L or CHEM 1203 and CHEM 1201L).

BIOL 3123 Prokaryote Biology (Typically offered: Spring)

An in-depth coverage of prokaryote diversity, genetics, metabolism, growth, structures and functions. Prerequisite: BIOL 2533.

BIOL 2533 Cell Biology (Typically offered: Fall and Spring)

Introduction to cell structure, cell processes, biological polymers, energetics, and diversity. An introduction to biochemistry and cell chemistry. Recommended: (CHEM 1123 and CHEM 1121L) or (CHEM 1223 and CHEM 1221L) or equivalent. Prerequisite: BIOL 1584, or BIOL 1543 and BIOL 1541L.

BIOL 2323 General Genetics (Typically offered: Fall and Spring)

Surveys of Mendelian, molecular, and population mechanisms of inheritance and gene expression in prokaryotes and eukaryotes. Lecture 3 hours per week. Prerequisite: (BIOL 1584 or BIOL 1543 and BIOL 1541L) and (CHEM 1103 or CHEM 1203) and (MATH 1203 or STAT 2023 or equivalent).

CHEM 2613 Organic Physiological Chemistry (Typically offered: Fall, Spring and Summer)

One semester survey of organic chemistry necessary for understanding of biological systems, with some related physiological chemistry. Lecture 3 hours per week. Corequisite: CHEM 2611L and related course component drill section for CHEM 2613. Prerequisite: (CHEM 1073 and CHEM 1071L) or (CHEM 1123 and CHEM 1121L) or (CHEM 1123H and CHEM 1121M) or (CHEM 1223 and CHEM 1221L).

CHEM 3613 Organic Chemistry II (Typically offered: Spring and Summer)

Basic chemistry of aromatic and carbonyl compounds: properties and reactions. Lecture 3 hours per week. Corequisite: CHEM 3611L and related course component drill section for CHEM 3613. Prerequisite: (CHEM 3603 and CHEM 3601L) or (CHEM 3603H and CHEM 3602M) or (CHEM 3703 and CHEM 3702L).

FDSC 3103 Principles of Food Processing (Typically offered: Fall)

The course is designed as an overview of the unit; food processing operations common to all types of food processing plants. Examples will be drawn from international food processing operations processing fruits and vegetables, poultry and meats, and oil seeds and cereal grains. Emphasis on oral communication and critical

thinking skills. Corequisite: Lab component. Prerequisite: CHEM 1123 and CHEM 1121L and (MATH 2043 or MATH 2554).

FDSC 2603 Science in the Kitchen (Typically offered: Fall)

In recent years science has found its way into the kitchen and cooking into laboratories and food processing plants. This course is designed to integrate science and cooking to help students appreciate the chemical and physical properties of foods and understand how the processes used when handling, preparing, and storing foods affect these properties.

FDSC 2523 Sanitation and Safety in Food Processing Operations

Topics covered will provide an understanding of the control of microbial, chemical, and physical food hazards as well as emerging food safety issues. Course will include a discussion of sanitation, cleaners and sanitizers, sanitary equipment and facility designs, and microbial growth and control in food processing operations.

Lecture/discussion. Students may not receive credit for both FDSC 2523 and FDSC 2503. (Typically offered: Spring)

FDSC 4122 Food Microbiology (Typically offered: Fall)

The study of food microbiology including classification/ taxonomy, contamination, preservation and spoilage of different kinds of foods, pathogenic microorganisms, food poisoning, sanitation, control and inspection and beneficial uses of microorganisms. Prerequisite: BIOL 2013 and BIOL 2011L or BIOL 2533.

This course is cross-listed with BIOL 4122.

CHEG 2133 Fluid Mechanics (Typically offered: Fall, Spring and Summer)

Analysis and design of fluids handling equipment and systems. Application of the principles of fluid statics, fluid dynamics, compressible flow, etc. Prerequisite: MATH 2584 or 2584C and Pre- or

Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614 or INEG 2103).

CHEG 3144 Heat and Mass Transfer (Typically offered: Fall and Spring)

Applications of the principles of conduction, convection and radiation to the analysis and design of chemical processing heat transfer equipment and systems. Fundamentals of chemical diffusional and convection processes.

Corequisite: Drill component. Pre- or Corequisite: CHEG 3323. Prerequisite: CHEG 2133 with a C or above and MATH 2584.

BENG 3113 Measurement and Control for Biological Systems (Typically offered: Spring)

Principles of sensors, instruments, measurements, controls, and data acquisition systems, with emphasis on applications for biological systems; including basic circuit analysis, sensor calibration and hardware selection.

Basic process monitoring and control methods, including hardware and software. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: PHYS 2074.

BENG 3733 Transport Phenomena in Biological Systems (Typically offered: Fall)

Basic principles governing transport of energy and mass. Estimating transfer of energy (heat) through solid bodies and liquid/gas boundary layers through conduction, convection, and radiation. Modeling the rates at which biological reactions occur (kinetics). Estimating the transfer of diffusing mass (gas or liquid) through solid bodies and liquid/gas boundary layers, including processes such as drying and oxygen diffusion. Three hours lecture per week. Pre- or Corequisite: (CVEG 3213 or MEEG 3503 or CHEG 2133) and MATH 2584. Prerequisite: (MEEG 2403 or CHEG 2313).