

CALIFORNIA STATE UNIVERSITY  
SAN MARCOS

Proposals for New Certificates in

**EngiBeer<sup>TM</sup>**

**Certificates of Specialized Study:  
Basic EngiBeer<sup>TM</sup> and Brewing Science**

Each new Certificate is subject to review and approval by the relevant college curriculum committee and the Academic Planning and Policy Committee of the Academic Senate. Requests for approval of a Certificate should be submitted according to the timeline of the appropriate college curriculum committee and should follow the format below:

**1. Full and exact title of the Certificate program and level of the program (Certificate of Specialized vs. Advanced Study). Name and position of the person(s) submitting the proposed Certificate. Intended implementation date of the program.**

**Title:** Certificate of Specialized Study in Basic EngiBeer<sup>TM</sup> (Beginning Level)

**Title:** Certificate of Specialized Study in Brewing Science (Intermediate Level)

**Submitter:** Jacqueline A. Trischman, PhD  
Professor, Chemistry & Biochemistry

**Intended Implementation Date:** Spring, 2018

**Format:** Both certificates are to be taught as self-support programs through (define) EL under the direction of a Faculty Director and Steering Committee.

Both certificates are discussed in this proposal because some courses will be included in both certificates. The Basic EngiBeer<sup>TM</sup> Certificate will be a required pre-requisite to the Brewing Science Certificate.

**2. List of the existing programs in the discipline(s) under which the new Certificate is to be offered.**

Both certificates draw on material from a wide variety of disciplines. The introductory certificate (Basic EngiBeer<sup>TM</sup>) is designed to give an understanding of the beer as a product and of the process of brewing with a choice to go into more depth in the business side, process side, or the science of brewing. The more advanced certificate (Brewing Science) includes coursework heavy in Biology and Chemistry, as do most traditional Brewing Science programs. Because this certificate is designed to support the local burgeoning brewing industry, students in the advanced certificate will also take classes in Business and on all aspects of brewery operations.



Because of the interdisciplinary nature of the certificates, they will be housed in the College of Science and Math rather than within a single Department. In addition, faculty from CHABSS, CoBA, and the Library will be included on the Steering Committee for the program. Put list up front

### **Existing Brewing Programs in California**

San Diego State University: The Business of Brewing. A 4-course (12 unit) certificate that prepares students to work as servers and in the business positions at breweries.

UC San Diego: Brewing Certificate. A 31-unit (quarters) evening program that requires a strong science background or extensive brewing experience to enter. This program is appropriate for those who want to become brewers or to open a brewery. However, its capacity is limited, and it is not in a good location for commuting from North County during rush hour.

UC Davis: A B.S. in Food Science with three courses in brewing. This is a full science major.

Cal Poly SLO: Launching a Brewing, Distilling, and Wine certificate program in 2017.

### **3. List of the existing program(s) that may be affected by the proposed Certificate.**

Because the EngiBeer<sup>TM</sup> Program is to be offered through Extended Learning, and all courses are new, little impact on existing programs is expected.

Courses that draw on faculty expertise from the following disciplines will be included in the program:

- History
- Liberal Studies (Geography)
- Engineering/Physics
- Chemistry & Biochemistry
- Biological Sciences
- Business Administration

Those disciplines with more than a single course involved in the certificate were asked to sign off on the program. All impacted programs were asked to review appropriate courses.

### **4. Purpose of the proposed Certificate, including specific academic objectives served, professional applications, potential student market, and a statement explaining the need for the Certificate in comparison to existing related majors, minors, and Graduate programs.**

One of the most rapidly growing segments of the North San Diego County business community is the craft brewing industry. With 17 breweries located within seven miles of

the campus, CSUSM is uniquely situated to train the workforce needed by this growing industry. The days when liking craft beer was a sufficient qualification to land a job at a brewery are gone as the operations become more sophisticated and competitive. With only a single program to train brewers in San Diego County and two other programs in the state, there is an expanding gap between the number of trained workers needed by breweries and the educational opportunities available. The purpose of the proposed certificates is to fill that gap.

Craft brewing is not only a rapidly growing industry in San Diego County and throughout the state of California, but also across the nation. In 2016, the \$22 billion craft sector represented 21% of the value of the \$106 billion US beer market, according to the Brewers Association, up from just \$8.8 billion six years ago (<https://www.ft.com/content/c9f77348-8ccc-11e6-8cb7-e7ada1d123b1>). The majority of Americans now live within 10 miles of a craft brewery. In San Diego County, the Brewers Association reports over 70 microbreweries, defined as producing less than 15,000 barrels of craft beer and selling more than 75% off-site, and another 45 brewpubs. In California, the number of microbreweries grows to nearly 300, and up to almost 500 if brewpubs are counted as well. Sales for the craft brewing industry grew by 22% in 2014 by dollar sales growth and by 17.6% in volume. Statewide, production has almost doubled in only three years. With this vibrant presence in California, contributing \$6.9M to the state economy in 2014, consumers continue to demand high quality, full flavor, and innovation. To put San Diego's contributions in perspective with respect to these numbers, San Diego County has the most active brewery licenses in the state (130), twice as many as the county with the next most licenses (LA County). Small and independent craft brewers continue to pop up and flourish in the local area of North San Diego County, including two December openings in North County: Burgeon Beer Co., co-founded by Anthony Tallman, one of our guests at the development meetings for the program, and SR76, a brewery attached to Harrah's Resort in Valley Center. According to a recent SanDAG report, the small and independent craft breweries in North San Diego County accounted for an estimated 1,717 technical jobs in the region at breweries and brewpubs in 2010. With more than 30% growth since 2010, several hundred jobs have been added to this industry in San Diego in the past few years and growth projections show another 70% growth in production by the year 2020 with a corresponding growth in workforce. City officials in San Diego claim that breweries are engines of the local economy because their large workforces boost other area businesses such as restaurants and grocery stores. (<http://www.latimes.com/local/lanow/la-me-beer-biotech-20161225-story.html> )

The local brewing industry is known for both the interpretation of historic styles of beers with new twists and the development of new styles with no precedent. As the industry matures, and they strive to continue this hallmark of innovation, more personnel with a knowledge of the industry and the science involved in brewing are needed. With very few programs designed to meet this need in our region, CSUSM is ideally situated to develop and deliver programs to support this thriving business community. The only program offered in San Diego currently is a certificate at UC San Diego that requires a science or engineering degree or years of brewing experience to be admitted to the program. Across California, UC Davis has a degree in Fermentation Science and Cal Poly Pomona offers a certificate program that includes 3 courses with no pre-requisites. This proposed program that may be taken by individuals with a desire to focus on the business side, enrich their understanding as a hobbyist, or by those wishing to gain more depth of understanding in the science of

brewing. In addition, through Extended Learning, the program includes the development of a lab-scale production facility, to be used both in the education of students and potentially by community partners. In this way, the Certificates in EngiBeer™ will develop innovative partnership that offer educational opportunities to a broad range of community members, including those seeking recreational enrichment and those seeking advancement or employment in the brewing industry or in related areas in the biotechnology or food production industries.

**Grant Supported:** Because this program is so inherently tied to the brewing industry, a Commission on the Extended University grant proposal (**Appendix A**) was written to bring industrial partners together for the development of a program that CSUSM could stand behind and that the industry would recognize as valuable. This proposal was funded, resulting in the following events:

**Jun 6, 2016      Brewing Industry Focus Group Meeting      McMahon House**

Over 20 local brewing industry representatives, including brewers and executives, met with faculty and staff from CSUSM to discuss the first draft of the curriculum developed by a faculty working group. Originally, the curriculum was presented as a Professional Science Masters degree. However, after consideration of the input from the brewers, this was deemed too intensive with much less demand than a beginning and advanced set of certificates. (See **Appendix B** for original proposed curriculum presentation.)

**Oct 4, 2016      Executive Focus Group Meeting      Culver Beer, Carlsbad, CA**

After review of the second draft of the curriculum with several brewery executives/owners, including Paul Sangster of Rip Current and Tomme Arthur of Port Brewing/Lost Abbey, a third draft of the curriculum was presented to a select focus group of 10 brewers and industry executives. (See **Appendix C** for revised curricular proposal.)

We also met personally with the publisher of West Coaster San Diego, a monthly beer magazine about the San Diego Beer Industry. After each of these events or series of meetings, a steering committee comprised of staff from EL and faculty from CSM, CoBA, and CHABSS worked on the development of the curriculum. Once the courses were set, we reached out to experts in each area to help develop each course in collaboration with faculty in the appropriate discipline. The courses cover a range of topics from all three colleges with the majority of advanced coursework involving topics from biological or physical sciences.

**Certificate Program Student Learning Outcomes**

The curriculum will prepare all **Brewing Science Certificate** graduates to:

1. Evaluate the quality of beer and assess its nutritional content.
2. Develop a formula for producing a high quality beer and ....
3. Discuss the importance of each step in the brewing process.
4. Operate a fermentor.
5. Understand the role of each ingredient in beer production and the role of yeast and bacteria in food production and safety.
6. Work within the regulatory environment of Southern California and to know how to adapt to the rules and regulations of other states
7. Conduct a feasibility study and develop a business plan for the start-up or operation of a sustainable and responsible microbrewery business.

The **Certificate of Specialized Study in Basic EngiBeering™** will cover PSLOs 1-5 at an introductory level, and then cover 6 or 7 at the intermediate level, whereas the **Certificate of Specialized Study in Brewing Science** will offer the opportunity to reach mastery in all PSLOs.

**5. List of the courses, by catalog number, title, and units of credit, as well as total units to be required under the proposed Certificate.**

**Required for Either Certificate**

- ENGB 300 From Sumer to San Diego: The Evolution of Beer Across Time and Space (2 units)
- ENGB 301 Craft Beer Recipe Development Lab (1 unit)
- ENGB 310 Sensory Evaluation of Beer (3 units)
- ENGB 350 Process EngiBeering™ I (3 units)
- ENGB 351 Process EngiBeering™ II (3 units)
- ENTR 400 Entrepreneurship and Marketing in the Craft Beer Industry (3 units)
- ENGB 401 Brewing Materials (3 units)
- ENGB 490 Innovation in Brewing Science and Technology (2 units)
- ENGB 500 Brewing Science I (3 units)
- ENGB 501 Brewing Science II (3 units)

**Electives for Brewing Science**

- ENGB 402 Beyond Brewing: Specialty Beverage Production (2 units)

**Note that two additional electives are under development for introduction once the program is established**

- ENGB 510 Advanced Sensory Evaluation and Food-Pairing (2 units)
- ENGB 520 Quality Assurance in the Brewery Lab (2 units)

**Courses in each certificate**

Basic EngiBeering™ Certificate – 12 units

Required:

- ENGB 300 (2 units)
- ENGB 301 (1 unit)
- ENGB 310 (3 units)
- ENGB 350 (3 units)

Elective – Choose one of the following:

ENGB 351 (3 units)

ENTR 400 (3 units)

ENGB 401 (3 units)

Brewing Science Certificate – 16 units\*

(Pre-requisite = Basic EngiBeering™ Certificate)

ENGB 351 (3 units)

ENTR 400 (3 units)

ENGB 401 (3 units)

ENGB 490 (2 units)

ENGB 500 (3 units)

ENGB 501 (3 units)

Elective – Choose any additional ENGB course at the 300 or 400 level (2 units)

\*One of the first 3 courses will have been taken in the Basic EngiBeering™ Certificate, so those 3 units are not included as part of this certificate.

**6. Definition of the minimum level of competence to be demonstrated to earn the proposed Certificate, and a description of the means of assessing that competence (examination, practicum, field experience, etc.).**

Each certificate is composed of a set of courses that will be graded independently. The advanced certificate will have a capstone experience of an industrial internship, but this will be graded as a separate course rather than as a means of assessing mastery of all certificate material. To earn the certificate, students must earn a C or higher in each course and have a final GPA of 3.0 or higher in the certificate courses.

**7. Description of assessment strategies for waiver of lower division requirements (where applicable).**

Because all course are to be taught at a 300-level or above, admission to the Basic EngiBeering™ Certificate will require an Associates degree or two years of college (60 semester units) that include a course in a Life Science and a course in a Physical Science OR 2 years of brewery operations experience. The Brewing Science Certificate will require the Basic EngiBeering™ Certificate, or current enrollment in the final courses to complete the program, as a pre-requisite. An online primer for Biology and Chemistry background will be developed if needed. The initial plan is to assume basic biology and chemistry backgrounds

and teach from there. If this is determined not to be feasible, the online primers will be developed.

**8. New courses to be developed. Include proposed catalog descriptions in the Certificate proposal. "C-forms" for these courses should accompany the proposed Certificate package for curricular review.**

**ENGB 300 From Sumer to San Diego: The Evolution of Beer Across Time and Space (2 units)**

Surveys the development of beer across history and geography from its origins in Sumer and Iran to its contemporary manifestations in San Diego. Through readings and discussion, students are introduced to the evolution of beer, the ethical debates about beer, the varieties that exist and the ongoing operation of the contemporary San Diego Craft Brewing Industry.

**ENGB 301 Craft Beer Recipe Development Lab (1 unit)**

Fundamental introduction to the ingredients and materials needed to brew beer on a small scale. Includes introduction to hops, grain, and yeast and how they are used in the brewing process. Students will learn about the entire brewing process and which ingredients are used at each stage of the brewing process. *Note: Students must be 21 and over to take this course.*

**ENGB 310 Sensory Evaluation of Beer (3 units)**

Provides an overview of beer styles, their origins, and associated flavors, as well as a continuing analysis and deeper understanding of the brewing process connected with the various beer styles. Begins to prepare students for a number of certification exams such as the Beer Judge Certification Program, an exam which enables people to begin evaluating craft beers at brewers' competitions, and the Cicirone Program which certifies beer professionals in much the same way as somelier's are certified for wine. Develops in students a deeper appreciation and understanding of one of the world's most popular drinks. *Note: Students must be 21 and over to take this course.*

**ENGB 350 Process EngiBeering™ I (3 units)**

This course is the first in a two-course sequence designed to familiarize students with large-scale/commercial brewing production, including equipment and techniques. Topics covered include brewery design and layout, equipment acquisition and use, ingredients, creating and adjusting recipes, along with basic sanitation, brewery safety and legal requirements. Curriculum includes creative projects and real world advice from experienced brew-masters. Students enrolling in this course should have prior knowledge of beer-making and the brewing process. *Pre-requisite: ENGB 300, 301 or substantial brewing experience with consent of instructor*

**ENGB 351 Process EngiBeering™ II (3 units)**

Second in a two-course sequence designed to familiarize students with large-scale/commercial brewing production. Emphasizes equipment maintenance and advanced sanitation, water management, use of laboratory techniques for monitoring the brewing process, bottling/packaging techniques, and further investigation of brewery cost analysis and

design. Builds on ENGB 350 by providing further learning pertaining to the management and/or ownership of a craft brewery. Curriculum includes creative projects and real world advice from experienced brew-masters. *Prerequisite: ENGB 350*

**ENTR 400 Entrepreneurship and Marketing in the Craft Beer Industry (3 units)**

Explores the management and marketing challenges inherent in starting a new craft brewing venture. Covers key entrepreneurial topics such as the role of the founder; the power of stories to new venture creation; social entrepreneurship; human resources; and negotiation strategies. Moreover, market analysis, brand positioning, packaging, pricing, distribution and promotional campaigns will be explored as parts of an overall marketing strategy.

**ENGB 401 Brewing Materials (3 units)**

Introduces the chemistry of water, hops, barley, and other ingredients in the context of brewing. Emphasizes water quality, testing, and purification, discussions of polarity and pH. The flavor chemistry of hops, and the development of a grain bill. *Prerequisites: ENGB 301 or suitable brewing experience.*

**ENGB 402 Beyond Brewing: Specialty Beverage Production (2 units)**

Extends topics covered in ENGB 401 with application to specialty beverage production. Introduces the history, physiology, microbiology and flavor contributions of wood to specialty beverages, and also the maintenance of wooden vessels. Explores the fundamental differences in fermentation and production of barrel-aged beer, cider, perry, and saké. Principles of distillation and its application to brandy will also be discussed. *Prerequisite: ENGB 401*

**ENGB 490 Innovation in Brewing Science and Technology (2 units)**

Capstone course in the EngiBeering™ program. Introduces students to the latest challenges at the small, medium, and large sizes of brewery operations and requires students to work in a brewery or brewing business. *Prerequisites: ENTR 400 and ENGB 401, both with a grade of B or better*

**ENGB 500 Brewing Science I (3 units)**

Explores the physical, chemical, and biochemical changes that occur during the following stages of the brewing process: malting (steeping, germination, kilning, roasting), milling, mashing, lautering/extracting, boiling/sterilizing, adding hops, and fermentation. *Prerequisites: ENGB 401.*

**ENGB 501 Brewing Science II (3 units)**

Continuation of the brewing process from fermentation to final production. Presents a comprehensive study of the microbiology of beverage production, including microbial growth, fermentation processes and procedures, beverage finishing in addition to food safety and scientific hazard analysis. *Prerequisite: ENGB 500.*



**9. List of all present faculty members, with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience, who would teach in the proposed aggregate of courses.**

Kyle Adams

B.S. in Business Administration with the Emphasis in Management 2013 CSUSM

General Manager, Prohibition Brewing Company

Over 10 years of brewing management experience on multiple systems ranging in size from a 5 gallon home brew system to a 300 gallon Premier Stainless automated system.

Bennett Cherry

Professor, Department of Management, College of Business Administration

Ph.D. in Organizational Behavior 2000 University of Arizona

Experience in the development of entrepreneurship programs and coursework and in teaching related topics to students with entrepreneurial ambitions.

Gwen Conley

B.S. in Biology 1993 U Col Boulder, Formal training in Sensory Evaluation from UC Davis

Director of Quality Assurance at a Brewery for 9 years

Recognized author in the field of sensory analysis of beer with 8 years of teaching experience.

Charles J. De Leone,

Professor, Department of Physics

Ph.D. in Physics

1995 UC Davis

Experience in the development of engineering programs and coursework and in teaching related topics to students with minimal preparation in physical science coursework.

Greig Tor Guthey

Associate Professor of Public Policy and Planning & Geography Coordinator, Department of Liberal Studies

Ph.D. in Geography

2004 UC Berkeley

Economic Geographer with experience in the study of organizations, global value chains, industrial districts, and place, and teaching experience in regional geography, development, agri-food systems, wine, and sustainability.

Kambiz M. Hamadani

Assistant Professor, Department of Chemistry and Biochemistry

Ph.D. in Biochemistry and Molecular Biology 2008 UC Berkley???

Experience in biochemical techniques including culture of microorganisms and in teaching biochemistry courses at the level of this program.

Robert Iafe

Assistant Professor, Department of Chemistry and Biochemistry

Ph.D. in Organic Chemistry 2011 UC Los Angeles

Experience in organic chemistry techniques including distillation and extraction and in teaching chemistry courses at the level of this program.

James Jancovich

Associate Professor, Department of Biological Sciences

Ph.D. in Molecular and Cellular Biology 2007 Arizona State University

Classically trained microbiologist with experience teaching microbiology, sterile technique and sanitation, microbial growth and fermentation science.

Rebeca Perren

Assistant Professor, Department of Marketing, College of Business Administration

Ph.D. in Business Administration, Marketing Track 2015 University of Central Florida

Experience in the development and teaching of marketing coursework.

James Petti

Head Brewer, Vice President, Co-owner of Wavelength Brewing Co.

11 years brewing industry experience including tasting room management, bottling line, brewing, consulting and new brewery design/setup. Worked for various breweries including Port Brewing and Karl Strauss, as well as handling all production at Wavelength.

Mike Stevenson

B.S. in Economics from CSUSM, Graduate of Brewing Program at UCSD

Co-owner and head brewer at Culver Beer Company in Carlsbad with 4 years UCSD of international and local experience in the brewing industry.

Jacqueline A. Trischman (Director)

Professor, Department of Chemistry & Biochemistry

Ph.D. in Marine Chemistry 1993 UC San Diego

Experience in the study of the chemistry of hops, bacterial fermentation on an industrial scale, and in teaching chemistry to non-science majors as well as science majors.

#### **10. Instructional resources (faculty, space, equipment, library volumes, etc.) needed to implement and sustain the Certificate program.**

Faculty will be hired as needed to teach each course based on the self-support model shown below.

Plans are being drawn up for an offsite lab to accommodate several boiling/mashing stations, 12 fermenters, and cold storage areas. Until such a facility can be built, we are planning to use home brew kits at local breweries to teach the lab as needed.

“Catalog Copy”

Certificate of Specialized Study in Basic EngiBeer<sup>TM</sup> (Engb)

Craft brewing is a vibrant and innovative industry in San Diego County and across the nation. As the industry grows, workers trained in all facets of the brewery operations are needed. This program offers educational opportunities to those seeking advancement or employment in the brewing industry as well as to those seeking recreational enrichment.

The Certificate of Specialized Study in Basic EngiBeer<sup>TM</sup> requires successful completion of 12 semester units of coursework. Classes were developed through collaborations between CSUSM faculty across three colleges and members of the local brewing community with expertise in the craft beer industry. Each class will be taught by experts in the field with using materials applied to beer and the brewing process.

#### Admission Requirements and Process

- 1) Students must be 21 years of age or older.
- 2) One of the following are required for admission to the Certificate of Specialized Study in Basic EngiBeer<sup>TM</sup>:
  - An Associate's Degree from an accredited college that included a course in a Life Science and a course in a Physical Science
  - Two (2) years of college (60 semester units) that include a course in a Life Science and a course in a Physical Science
  - Two (2) years of brewery operations experience
- 3) Each certificate program has an application that must be completed. The application may be found at [www.csusm.edu/EL/ENGB](http://www.csusm.edu/EL/ENGB)
- 4) Submission of current resume to show previous experience.
- 5) Hard copy transcripts from all colleges and universities needed for admission mailed to:

California State University San Marcos  
Extended Learning  
Attn: ENGB Program  
333 S. Twin Oaks Valley Rd  
San Marcos, CA 92096

#### Courses (12 units total)

##### Required (9 units)

ENGB 300 (2 units)

ENGB 301 (1 units)

ENGB 310 (3 units)

ENGB 350 (3 units)

##### Elective (3 units) – Choose one of the following:

ENGB 351 (3 units)

ENTR 400 (3 units)

ENGB 401 (3 units)

Certificate of Specialized Study in Brewing Science

Brewers and those who work in the science of brewing need more substantial training in the underlying principles of malting, mashing, boiling, fermenting, and aging that determine the ultimate flavors of beers and brewed beverages. The Brewing Science Certificate provides this more advanced training to allow graduates to work confidently in the brewing and quality control areas of craft breweries. This certificate is more rigorous than the Basic EngiBeer™ Certificate, with higher level science work that requires significant dedication to master.

#### Admission Requirements and Process

- 1) The Brewing Science Certificate requires evidence of completion or enrollment in the coursework needed to complete the Certificate of Specialized Study in Basic EngiBeer™
- 2) The application may be found at [www.csusm.edu/EL/BREW](http://www.csusm.edu/EL/BREW)

Courses (16 units total)

Required (14 units – 3 units will have been taken in the ENGB Certificate)

ENGB 351 (3 units)

ENTR 400 (3 units)

ENGB 401 (3 units)

ENGB 490 (2 units)

ENGB 500 (3 units)

ENGB 501 (3 units)

Elective (2 units) – Choose any additional ENGB course.

## Project Abstract

One of the most rapidly growing segments of the North San Diego County business community is the craft brewing industry. With more than 16 breweries located within seven miles of the campus, CSUSM is uniquely situated to train the workforce needed by this growing industry. With only a single program to train brewers in San Diego County and two other programs in the state, there is an expanding gap between the number of trained workers needed by breweries and the educational opportunities available. The days when liking craft beer was a sufficient qualification to land a job at a brewery are gone as the operations become more sophisticated and competitive.

A national trend that mirrors the needs of the brewing industry is that of graduate level programs that combine both scientific training and business education. This trend is reflected in the emergence of the Professional Science Masters (PSM), the fastest growing segment of science graduate education. The PSM degree adeptly addresses the documented need for management-trained professionals “for technology-based companies, governmental agencies, and non-profit organizations” (NPSMA.org).

To ameliorate the skilled workforce gap and leverage the strength of the PSM program model, CSUSM’s College of Science and Mathematics (CSM) and College of Business Administration (CoBA) propose to collaboratively develop a Professional Certificate in Brewing Science program, that may eventually become a Master of Science in Brewing Science (a PSM program). The Professional Certificate in Brewing Science program will mitigate the shortage of trained brewery personnel as well as prepare program participants for advanced careers, e.g. management, in food science by integrating business courses.

The program objective is to train an expertly skilled workforce to fulfill the need of the emerging and evolving craft brewing industry through the development of a Professional Certificate in Brewing Science program. To that end, the Professional Certificate in Brewing Science program will include: 1) an introduction to the fermentation industry; 2) science-rich exposure to the field of zymurgy; 3) MBA-level business courses; 4) industry-related fundamentals; 5) an internship, residency, or cooperative project; and 6) the build out of a pilot brewing facility to be used for both educational and community partnership purposes.

The Professional Certificate in Brewing Science will meet the following objectives for the Commission on the Extended University: 1) Meet California’s economic and workforce development needs; 2) Increase access to educational opportunities by serving broader constituencies; 3) Creatively develop new programs; 4) Provide personal and lifelong learning opportunities; and 5) Generate new revenues.

## **Project Description**

### ***Stated Need***

Craft brewing is a rapidly growing industry in San Diego County and throughout the state of California. Across the nation, the majority of Americans live within 10 miles of a craft brewery. In San Diego County, the Brewers Association reports over 70 microbreweries, defined as producing less than 15,000 barrels of craft beer and selling more than 75% off-site, and another 45 brewpubs. In California, the number of microbreweries grows to nearly 300, and up to almost 500 if brewpubs are counted as well. Sales for the craft brewing industry grew by 22% in 2014 by dollar sales growth and by 17.6% in volume. Statewide, production has almost doubled in only three years. With this vibrant presence in California, contributing \$6.9M to the state economy, consumers continue to demand high quality, full flavor, and innovation. Small and independent craft brewers continue to pop up and flourish in the local area of North San Diego County, accounting for an estimated 1,717 technical jobs in the region at breweries and brewpubs in 2010 (SanDAG report). With more than 30% growth since 2010, several hundred jobs have been added to this industry in San Diego in the past few years and growth projections show another 70% growth in production by the year 2020 with a corresponding growth in workforce.

The local brewing industry is known for both the interpretation of historic styles of beers with new twists and the development of new styles with no precedent. As the industry matures, and they strive to continue this hallmark of innovation, more personnel with a knowledge of the industry and the science involved in brewing are needed. With very few programs designed to meet this need in our region, CSUSM is ideally situated to develop and deliver programs to support this thriving business community. The only program offered in San Diego currently is a certificate at UC San Diego that requires a science or engineering degree to be admitted to the program. Across California, UC Davis has a degree in Fermentation Science and Cal Poly Pomona offers a certificate program that includes 3 courses with no pre-requisites. CSUSM will propose a program that may be taken by individuals with a desire to focus on the business side, enrich their understanding as a hobbyist or by those wishing to gain more depth of understanding in the science of brewing. In addition, the program will include the development of a pilot production facility, to be used both in the education of students and by community partners. In this way, the Professional Certificate in Brewing Science will be an innovative partnership that offers educational opportunities to a broad range of community members, including those seeking recreational enrichment and those seeking advancement or employment in the brewing industry or in related areas in the biotechnology or food production industries.

### ***Project Objectives, Goals, and Measurable Outcomes***

The objective of the Professional Certificate in Brewing Science is to train an expertly skilled workforce to fulfill the imminent needs of the emerging and evolving brewing industry. The Brewing Science curriculum will be developed and taught by both CSUSM tenure track faculty across the College of Science and Math, the College of Business Administration, and the

College of Humanities, Social, and Behavioral Sciences and by industry experts as lecturers. This is another area where CSUSM is uniquely positioned to develop this program with an abundance of experts in this field in the local region.

Nationally, there is an increased focus on graduate level certificate programs which can lead towards a full Masters, that combine both technical skills and business acumen. This trend is reflected in the emergence of the Professional Science Masters (PSM) – the fastest growing segment of science graduate education. The PSM degree adeptly addresses the documented need for management-trained professionals “for technology-based companies, governmental agencies, and non-profit organizations” (NPSMA.org). Moreover, the California State University (CSU) system is encouraging campuses to develop PSM programs, given their ability to meet industry needs and prepare students for the workforce. The Professional Certificate in Brewing Science will ultimately become a designated PSM program, complementing the only other food science PSM in the state, a Viticulture and Enology PSM offered by UC Davis.

The design of Professional Certificate in Brewing Science will be quite innovative, comprised of three (3) stackable certificates that can be obtained individually or can eventually result in the PSM when all are taken and an internship or research project is completed. The first certificate, “Craft Brewing,” will be comprised of courses that introduce fermentation science, the brewing process, the culture of beer, including history and ethics, an introduction to the sensory evaluation of beer, and the basic design and operations of brewery facilities. The second certificate, “Brewing Science,” would be a track for students with a science background, bearing pre-requisites including biochemistry and microbiology for some of the coursework. The coursework in Brewing Science would include topics on yeast and beer production, the sensory chemistry and evaluation of beer, brewery quality assurance, sustainability of brewery operations, and a lab on innovation in brewing science and technology that includes a research project or internship. The third certificate, Brewery Management and Operations, would focus on the business aspects of craft brewing. Coursework would include: 1) legal aspects of beer production, including food safety and packaging and alcoholic beverage control; 2) entrepreneurship and marketing, including topics such as branding and packaging, social marketing, new venture management, collaboration and competition, social entrepreneurship, carving a niche, and business model canvas; and 3) business strategy, including sustainable operations; corporate social responsibility, and feasibility analysis. Each certificate would include 10-12 units, and would take 1.3 semesters to complete full time. The entire Professional Certificate in Brewing Science program would be completed in two years of full time study. Students will be able to choose an overall emphasis on product development and quality or operations management by choosing between several electives.

The curriculum will prepare all Professional Certificate in Brewing Science graduates to:

1. Understand the role of yeast and bacteria in food production and safety.
2. Operate a fermentor.
3. Develop a formula for and produce a high quality beer.
4. Evaluate the quality of beer and assess its nutritional content.

## Professional Certificate in Brewing Science

5. Work within the regulatory environment of Southern California and to know how to adapt to the rules and regulations of other states
6. Conduct a feasibility study and develop a business plan for the start-up or operation of a sustainable and responsible microbrewery business.

In addition, each graduate will develop depth of knowledge, skills, and abilities through a research project or internship/semester in residence. For example, topics for projects might include supply chain management, distribution concerns, bottling line set-up or evaluation, facility layout, water reclamation, energy use studies, flavor development, analysis of flavor and chemistry of raw materials and products, fermenter optimization, yeast growth studies, grain profiling, and hops profiling. Some projects, such as a study of how water use can be minimized, may be useful to any industry with similar challenges, while others, such as hops profiling, may be more specific to the brewing industry.

The Professional Certificate in Brewing Science program which will become a designated PSM program, will support the University's goal to participate in the CSU-wide PSM degree initiative. In addition to filling this educational and skilled workforce need for the region, the Professional Certificate in Brewing Science will benefit the University by developing collaborations between an interdisciplinary group of faculty, staff, and community members. Beyond partnering through internships, another program goal is to develop an "Engibeering" facility that can be used to teach each student to brew on small scale (10 gallons) and to test new recipes and brewing methods for local industrial partners on a larger scale (100 gallons). This off-campus shared facility will be built out as partners contribute to the program.

The Professional Certificate in Brewing Science will meet objectives from the Commission on the Extended University in several ways. First, the degree will meet economic and workforce needs for San Diego County, the state of California, and the nation by addressing the need for skilled employees in the growing craft brewing industry. By integrating courses general business topics as well as in the management of food production facilities, the Professional Certificate in Brewing Science will prepare program participants for advanced careers in this industry as well.

Second, the Professional Certificate in Brewing Science program will increase access to educational opportunities at a broad range of personal and professional levels, including courses that can be taken by hobbyists, entrepreneurs, and by those who wish to find employment or seek advancement in the craft brewing industry. Third, with this innovative approach, industrial partners can send their employees for each of the certificates within the Professional Certificate in Brewing Science program, or ultimately for the entire PSM degree. Small craft breweries who cannot afford their own pilot operations will also be able to make use of pilot facilities to be developed for the culminating laboratory experience.



To accomplish the stated program objectives and meet the CSU Commission on the Extended University grant proposal objectives, we have outlined the following measurable project goals:

1. Establish a Zymurgy Advisory Council consisting of and Industry Advisory Council and a CSUSM Curriculum Development Committee (Measure – established members and meeting schedules of committees)
2. Plan, design, and develop the program curriculum for each of the certificates in the Professional Certificate in Brewing Science program and ultimately the overall PSM program (Measure – completed curriculum)
3. Submit curriculum for campus approval, including program proposal and all new course forms (Measure – completed approval form)
4. Develop a proposal for an “Engibeering” Facility in collaboration with local craft brewers (Measure – proposal ready to pitch to local industry)
5. Develop courses and identify/train potential instructors (Measure – courses developed and instructors trained)
6. Establish admission criteria and process for prospective students (Measure – admission criteria, process, and timeline)
7. Establish a long-range marketing plan and begin advertising to students regionally and nationally (Measure – marketing plan developed and activities begun)

### ***Project Length and Timeline***

It is proposed that the program development be one year in duration and begin May 1, 2016 and end on April 30, 2017. Table 1 provides a suggested timeline for meeting overall objectives.

**Table 1. Professional Certificate in Brewing Science Timeline**

<b>Program Objective</b>	<b>Proposed Completion Date</b>
Establish a Zymurgy Advisory Council	Spring 2016
Plan, design, and develop the program curriculum	Spring/Summer 2016
Submit curriculum for campus approval	Summer 2016
Develop a proposal for an “Engibeering” Facility	Summer 2016
Develop courses and identify/train potential instructors	Fall 2016
Establish admission criteria and process for prospective students	Fall 2016
Advertise/Interview/Hire Faculty	Spring /Summer 2017
Begin Cohort 1	Fall 2017

## **Implementation Plan**

The first stages of curriculum development will include the CSUSM Curriculum Development Committee, including key faculty and staff from the College of Science and Math, the College of Business Administration, the College of Humanities, Social, and Behavioral Sciences, and the Library. Specifically, faculty from Chemistry and Biochemistry, Biology, Physics, Liberal Studies, Management, Marketing and the Library will collaborate to develop the core curriculum and submit all appropriate forms. As the program will be submitted as a Pilot Program, the Fall 2017 launch goal is realistic and achievable.

Beyond the campus team, the University will also work in collaboration with an Industry Advisory Committee, with representation from local craft breweries, hops farms, and analytical and development labs. This advisory group will vet the curriculum developed by the Curriculum Development Committee, as well as help to inform operational and structural decisions and marketing strategies.

## **Project Impact**

The Professional Certificate in Brewing Science program will serve as a model for other CSUs, as it will blend science and business knowledge, skills, and abilities, and positively impact the region by preparing graduates for advanced careers in the brewing industry. The program framework allows for flexibility and the ability to adapt to the industry as it evolves. This model will allow the craft brewing industry to continue to be a significant economic driver in the region for many years to come, based on the scientific training of the local workforce and the entrepreneurial spirit that pervades North San Diego County.

The eventual goal for the Professional Certificate in Brewing Science program will be for it to become an official designated Professional Science Masters (PSM) program. It will be the only PSM specific to brewing in the country, and one of only two food science PSM programs in the state. This designation will contribute to the overall CSU efforts to support and grow PSM degree programs.

This program will leverage the established framework for curriculum development, including the use of a collaborative model bringing internal faculty and staff committees together with external partners. It is anticipated that this collaborative approach will lead to stronger relationships with the local craft beer industry, which will lead to sponsored research and internship opportunities and potentially to opportunities for advancement.

The Professional Certificate in Brewing Science program will continue on a self-support model once the CEU funding ceases. Based on regional needs and demand of the local hobbyist community, it is anticipated that the introductory certificate program will be full with two cohorts and the other two certificates will be full with one cohort in each at any given time.

### Dissemination Plan

The project, its curriculum, and enrollment data will be made available to other CSU campuses via Extended Learning. Program results may also be presented at various CSU Commission and statewide extended Education Leadership Council meetings. Additionally, CSUSM will present findings and reports at CSU Counterparts events and at meetings for the National Professional Science Master's Association (NPSMA).

### Evaluation Plan

Continuous evaluation and process improvement assessments are imperative to the efficacy of the program. By collecting data including graduate job placement, internship satisfaction and industry feedback, we will be able to provide measures to verify the program is meeting the region's economic and workforce development needs. Additional data will be collected to identify student demographics that assess if the program has increased access to educational opportunities by serving broader constituencies. Furthermore, at the end of each semester, we will obtain student and industry survey data which will provide measures regarding the value of the program to both the student and industry stakeholder groups. Lastly, the program budget will be tracked and analyzed to ensure that the program is generating a positive flow of revenue to enable future growth.

**Table 2. Professional Certificate in Brewing Science Budget**

Source of Funds	CEU Grant Request	Local Funds	Industry Partners	Project Total
<b><i>Salaries</i></b>				
Project Director	\$19,800			\$19,800
<b><i>Faculty Stipends</i></b>				
Curriculum Co-Development (34 units)	\$34,000			\$34,000
<b><i>Travel</i></b>				
Craft Brewers Events		\$2,500		\$2,500
<b><i>Miscellaneous</i></b>				
Craft Brewers/Experts Summit		\$5,000		\$5,000
Marketing & Recruiting		\$10,000		\$10,000
<b><i>Engibeering Facility</i></b>				
Student Lab – annual operating expenses		\$17,000		\$17,000
Student Lab – Set-up Costs			\$40,000	\$40,000
Pilot Facility			\$300,000	\$300,000
<b><i>Legal Fees</i></b>				
Trademarking, Licensing, Non-			\$25,000	\$25,000

disclosure agreements, etc.				
<b>Totals</b>	<b>\$53,800</b>	<b>\$34,500</b>	<b>\$365,000</b>	<b>\$453,300</b>

### **Budget Narrative**

#### ***Project Director***

Based on the proposed workload and involvement of the Project Director, a 3-unit release at \$2,200/unit for three semesters, will be included in the budget. The Project Director will coordinate the overall project, be responsible for ensuring that all course objectives are met within one-year timeframe and Chair the Zymurgy Advisory Committee.

#### ***Stipends***

Monies will be paid to faculty for program development at \$1,000/unit for 34 units totaling \$34,000.

#### ***Travel***

Money will be allocated for local travel to companies within the industry to discuss internships and to various Craft Brewing Industry events, such as the Craft Brewers Conference and BeerExpo America May 1-7, 2016 in Philadelphia, PA. No funds will be used to purchase alcohol at any time.

#### ***Miscellaneous***

**Summit.** Monies will be budgeted for the purpose of holding a Craft Brewer and Industry Expert Summit. The Summit will bring together university faculty, local-area business leaders, and university administration for the purpose of collaborative development of the Professional Certificate in Brewing Science program curriculum. The Summit meeting will provide the opportunity for community input in the project development. The Summit will be held in the early Fall semester in 2016.

**Marketing and Recruitment.** Marketing money will be used to develop print materials for the program. Monies will also be used to purchase mailing lists and contact information for local companies to disseminate program information. Monies will also be earmarked to advertise the program in the San Diego Business Journal and other local-area publications.

#### ***Engineering Facility***

**Student Lab.** A student fermentation lab can be set up with minimal start-up costs if needed, with fermenters costing only \$200 each or with industrial stainless steel fully plumbed at a cost of \$4,000 per fermenter with a goal of ten (10) units. The goal is the latter, though two stages of set-up may be needed. Operating costs will include a part-time technician and approximately \$5,000 per year of supplies.

**Pilot Facility.** Set-up of several 100-gallon or larger fermenters would allow a fully operational pilot –scale brewery complete with a bottling operation to be used for both educational and product development purposes. This facility would be entirely funded by community partners in

both the set-up and the continued operation. The estimate of \$300,000 includes leasing of space and set-up of 2 boiling kettles, mash tuns, medium sized fermenters with self-sterilization and computer control and monitoring, filtration systems, and a bottling and kegging system.

### ***Legal Fees***

To be most valuable to the community, students will be expected to participate in the brewing and development of actual local craft beers. To do this, licensing and non-disclosure agreements will be necessary. In addition, we would want to trademark any unique and wonderful products developed by classes in the facility. Alcoholic beverage sales would be a step that is anticipated much further down the line, but recipes may be licensed to local breweries right away.

# The Curriculum

Background

Learning Outcomes

Program Design

Courses



# Engibeering Proposed Student Learning Outcomes

The curriculum will prepare all Professional Certificate in Brewing Science graduates to:

- Understand the role of yeast and bacteria in food production and safety.
- Evaluate the quality of beer and assess its nutritional content.
- Operate a fermentor.
- Develop a formula for and produce a high quality beer.
- Work within the regulatory environment of Southern California and to know how to adapt to the rules and regulations of other states
- Conduct a feasibility study and develop a business plan for the start-up or operation of a sustainable and responsible microbrewery business.



# Program Design

The program would include three certificates:

## 1) *Craft Brewing*

- Basic Fermentation Science and the Brewing Process
- Intro to Brewery Engineering with Lab
- The Culture of Beer, including History and Ethics
- Intro to the Sensory Evaluation of Beer
- Design and Operations of Brewery Facilities – Business Intro





# Program Design

## 2) *Brewing Science*

- Pre-requisites of Biochemistry and Microbiology
- Yeast and Beer Production
- The Sensory Chemistry and Evaluation of Beer
- Brewery Quality Assurance
- Sustainability of Brewery Operations
- Innovation in Brewing Science and Technology – with a lab and internship



# Program Design

## 3) *Brewery Management & Operations*

- Legal Aspects of Beer Production
  - Food Safety and Packaging
  - Alcoholic Beverage Control
- Entrepreneurship & Marketing
  - Branding and Packaging -- Social Marketing
  - New Venture Management -- Collaboration & Competition
  - Social Entrepreneurship -- Carving a Niche
- Business Strategy (Another internship possibility)
  - Sustainable Operations
  - Corporate Social Responsibility
  - Feasibility Analysis



# Program Design

**A Professional Science Masters would involve these 3 stackable certificates plus an internship:**

## *Craft Brewing*

- Basic Fermentation Science and Brewing
- Intro to Brewery Engineering with Lab
- Culture of beer, including history and ethics
- Intro to the sensory evaluation of beer
- Basic design and operations of brewery facilities.

## *Brewing Science*

- Pre-req of Biochemistry and Microbiology
- Yeast and Beer Production
- Sensory Chemistry and Evaluation of Beer
- Brewery Quality Assurance
- Sustainability of Brewery Operations
- Innovation in Brewing Science & Technology Lab

## *Brewery Management & Operations*

- Legal Aspects of Beer Production
- Entrepreneurship & Marketing
- Business Strategy

# The Overall Program

Each certificate

- includes 10-12 units
- takes 1.3 semesters to complete full time

The entire Professional Certificate in Brewing Science program would be completed in two years of full time study.

Students will be able to choose an overall emphasis on product development and quality or operations management by choosing between several electives.



## Engibeering Curriculum Draft 2.1

### Courses

- 500a The Culture of Beer** (2 units) – Includes history, ethical discussions, discussion of types of beer, and a state of the industry survey
- 500b Craft Beer Recipe Development Lab** (1 unit – thinking 2 meetings per week for 8 weeks) – Includes an introduction to the home brewing process, and a discussion of ingredients. The students would brew their own beer.
- 501 Process Engibeering I** (3 units) – Introductory class that will serve as a pre-req to others for the certificate program. Includes:
- The Brewing Process
  - Brewhouse calculations, such as efficiency, scale-up considerations, and feasibility studies
  - Scale and Design
  - Supply Chain Management Basics
  - Alcoholic Beverage Control Rules
- 502 Process Engibeering II** (3 units) – pre-req = 501 – Includes:
- Sanitation – attend a workshop that is offered to the class plus another 20 attendees
  - Sustainability – Discussion of water use, energy efficiency, supplies, and packaging – another that would be a good workshop
  - Finishing from the Process and Business Perspectives – Cost Analyses, Distribution, and Marketing Considerations.
  - Maintenance of the Operations
  - Project Management Strategies
  - Process Hazard and Compliance Analyses (Business side, not science)
- 503 Sensory Evaluation of Beer** (2 units) – No pre-req, but suggested that it be taken after 500. Discussions of beer styles, regions, brewing processes, and flavors. Will prepare students for the BJBC Exam.
- 504 Entrepreneurship and Marketing in the Craft Beer Industry** (3 units, 501 pre-req or not?) – Includes the business aspects that were not covered in other classes, such as:
- New Venture Management

- b. Branding
- c. Carving a Niche / Hyperlocal Model
- d. Collaborative and Competitive Models
- e. Social Entrepreneurship
- f. Social Marketing
- g. Corporate Social Responsibility

- 511 Brewing Materials (3 units)** – An introductory chemistry course that includes:
- a. Water quality, can be done as a workshop, but would be coupled with general chemistry intro in the discussion of purification of water, pH profile needed, and the mineral content, as well as requirements for the effluent
  - b. Hops Chemistry and Fruit and Herb Chemistry – all of the organic chem they will need to know
  - c. Barley and Wheat – Intro to biochem of starches versus sugars
- 521 Brewing Science I (3 units)** – pre-req = 501 and 511 – Malting and brewing basics up to fermentation with a focus on biochemical processes
- 522 Brewing Science II (3 units)** – pre-req = 521 – Fermentation through finishing with a microbiology focus and including food safety aspects of the operation and a scientific hazard analysis
- 523 Distillation and Specialty Beverage Production (2 units)** – pre-req = 511 – This will teach them about the process of making hard liquor, cider, root beer, and other non-beer/wine beverages.
- 524 Quality Control in the Brewery Lab (2 units)** – pre-req 503 and 522 – Analyze the quality of the product and learn how to monitor production.
- 551 Innovation in Brewing Science and Technology (3 units)** – Pre-req = either 502 or 522 – Combine a speaker series with a weekly discussion and internship. The model that appears to work well for similar courses is to have a discussion 1 week then a speaker the next, starting in the 3<sup>rd</sup> week of class when all internship business is flowing smoothly.

## **Certificates**

**Basics of Craft Brewing – A Beginning Certificate – 500a, 500b, 501, and 503 along with 4 units of electives (thinking we may add a few more) – 12 units**

**Basic Engineering (or ???) – An Intermediate Certificate – 500a, 500b, 501, 502, 504, and either 503 or 511 – 14-15 units (6 beyond Beginner)**

**Brewing Science – An Advanced Certificate – 500a, 500b, 501, 502, 511, 521, 522, 551, and one of the others – 23 units (11 beyond Intermediate, 17 beyond beginner)**



**Date:** April 4, 2017

**To:** Dr. Jacqueline Trischman

**From:** Dr. Jennifer Fabbi  
Dean, University Library

**Subject:** Library Review of the Proposal for Certificates of Specialized Study in Engibeering™ and Brewing Science

Thank you for the opportunity to respond to the proposal for the Certificates of Specialized Study in Engibeering™ and Brewing Science. The following information reviews the current capacity and describes probable needs of the CSUSM Library to support this program. Talitha Matlin, STEM Librarian; Ann Fiegen, Business Librarian; and Judith Downie, Special Collections and History Librarian, have reviewed the program proposal in its current form as well as individual course syllabi. Talitha Matlin (STEM Librarian) is the subject specialist for the College of Science and Mathematics and will serve as the primary liaison to the EngiBeer™ and Brewing Science program.

#### **Resource Implications**

Collections relevant to the proposed program would be housed with the CSUSM Kellogg Library, or more likely, virtually accessible through the Library website, The California State University at San Marcos (CSUSM) Library (<http://biblio.csusm.edu>). CSUSM has no branch or satellite libraries on or off campus.

#### *Existing Collections*

The CSUSM Library currently has monographs and journals to support undergraduate/graduate programs in History, Liberal Studies, Engineering/Physics, Chemistry & Biochemistry, Biological Sciences, and Business Administration, which also appear to be relevant to significant aspects of the Certificate in EngiBeer™ and Brewing Science program. Relevant current holdings include:

- Online access to a number of current periodicals of the food industry and trade, including (but not limited to):
  - Journal of the Institute of Brewing
  - International Journal of Food Science and Technology
  - International Journal of Gastronomy and Food Science
  - Food Science and Technology



- Food Engineering & Ingredients
- American Journal of Food Technology
- Science Direct books and journals related to Agricultural/Biological Sciences, Chemistry & Biochemistry, Business, Chemical Engineering, Economics, Microbiology, Materials Science, Physics, and Sports and Recreation
- Wiley Agricultural and Environmental Science journal collections
- Business and Marketing databases that are used for current beer, brewery, and distillery research projects:
  - ReferenceUSA
  - Ebsco Business Source Premier
  - ABI Inform Complete
  - Passport Euromonitor market research
  - Bizminer industry financial analysis
  - ESRI Community Analyst\*

\*ESRI Community Analyst is used for limited demographic and lifestyle data at the local to national level in the absence of a marketing database for local consumer consumption and purchase behavior data.

*Additional Needed Collections*

A number of courses in the EngiBeering™ and Brewing Science program will require term papers and real world projects with sponsored breweries. Examples of papers and projects could describe brewing processes, techniques, equipment and more, for beer and specialty beverages. Students will study marketing analysis of target groups using demographic and lifestyle statistics, supply chain and operations management processes, and financial analysis for start up and existing establishments. Depending on the specific requirements of each assignment for these courses, it is highly likely that students will need materials beyond what is already available in the Library's collections.

It is strongly suggested that teaching faculty contact the liaison librarian(s) prior to creating the research assignments to ensure adequate and appropriate library resources are available for students completing their required research.

Addition of the following collections is strongly recommended to provide an enriching educational experience and to maintain excellence in the research activities of faculty and students:

<b>Core Resources</b>	<b>Notes</b>	<b>Cost</b>
Monographs relating to new topics covered in EngiBeering™ and Brewing Science coursework	One-time funding to set up relevant holdings to enhance student research assignments.	\$2,500 annually
Subscriptions to local brewing publications (Celebrator, West Coaster,	Ongoing subscriptions for print as these are not fully digital. Subscriptions allow access to archived issues.	\$70 annually

San Diego Beverage Times)		
Membership in Brewers Association and San Diego Brewers Guild	Publications and member datasets. Ongoing membership expense.	\$300 annually
<b>Total for Year One</b>		<b>\$2870</b>

<b>Highly Recommended Resources</b>	<b>Notes</b>	<b>Cost</b>
SimplyMap with Simmons Local and Nielsen Prizm	Marketing database with detailed consumer purchase, consumption and demographic data.	\$13,000

The Special Collections and History Librarian is leading development of the new Brewchive™ Special Collection. This is an ongoing initiative charged with gathering and recording the history and growth of San Diego area breweries for research access. Example materials being gathered include corporate and individual histories, brewing recipes, current and historical legal resources, and marketing ephemera.

Faculty may, at any time, contact the librarian assigned to the Certificate in EngiBeering™ and Brewing Science program or the appropriate liaison librarian for the course regarding suggestions for acquisitions to the collection. Further, reports, assessment, and other analysis of library collections in all subjects are done in response to program review, by the library liaison. Due to permits and regulation of brewing and liquor that varies from state-to-state and even city-to-city, very specific resources will be needed as they are identified or made available. Teaching faculty are strongly encouraged to contact the liaison librarian for their course as far in advance as possible to ensure library resources are available to support student research.

*Reference and instruction by subject specialist librarians*

The Certificate in EngiBeering™ and Brewing Science program bears some topical overlap to History, Liberal Studies, Engineering/Physics, Chemistry & Biochemistry, Biological Sciences, and Business Administration.

The STEM Librarian has provided online and in-class instruction to students in the sciences. Most relevant to the Certificate in EngiBeering™ and Brewing Science is online instruction through course guides and online tutorials; Ms. Matlin would provide this type of instruction as part of her liaison responsibilities for the Certificate in EngiBeering™ and Brewing Science program. Faculty who require their students to incorporate a large amount of outside information into their research are encouraged to work directly with the STEM Librarian to prepare either in-person or online instruction for their classes.

The Business Librarian has provided in-class instruction and reference consultation to students in Business Administration. Instruction and in-depth reference consultation in beer industry,

beer start up, beer marketing, beer distribution have all been frequent student assignments for a number of years. Faculty who will be requiring their students to incorporate outside information into their research are encouraged to work directly with the Business Librarian to prepare instruction, reference, and consultation for students working on sponsored projects.

Beyond instructional impact, it is worth noting that each new program increases demand on all Library services from interlibrary loan to extended hours.

Basic information about the Library's collections and services follows in the table below.

Library holdings	<a href="http://biblio.csusm.edu/external/about-the-library/collection-overview">http://biblio.csusm.edu/external/about-the-library/collection-overview</a>
Circulation	<a href="http://biblio.csusm.edu/external/policies/books-and-media-borrowing-policies">http://biblio.csusm.edu/external/policies/books-and-media-borrowing-policies</a>
Inter-library loan services	<a href="http://biblio.csusm.edu/interlibrary-loan-borrowing-policies">http://biblio.csusm.edu/interlibrary-loan-borrowing-policies</a>
Reference/Research help	<a href="https://biblio.csusm.edu/research-assistance">https://biblio.csusm.edu/research-assistance</a>
Information Literacy Program	<a href="http://biblio.csusm.edu/about/departments/337/info">http://biblio.csusm.edu/about/departments/337/info</a>
E-thesis, project, and dissertation submission	<a href="http://biblio.csusm.edu/guides/subject-guide/193-CSUSM-ETD-Submission-Guide/">http://biblio.csusm.edu/guides/subject-guide/193-CSUSM-ETD-Submission-Guide/</a>

The Library looks forward to continued collaboration with those working on the proposed program and is happy to provide further information. It is essential that the program proposers continue discussions with the Library as the program is approved to ensure that students and faculty have sufficient information resources at the inception of the program.

cc: Judith Downie  
Ann Fiegen  
Katherine Kantardjieff  
Lauren Magnuson  
Arlene Martin  
Talitha Matlin