

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 Extended Learning (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.

Faculty involved in the initial development included:

#### CHABSS

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

#### CoBA

Bennett Cherry, Professor, Department of Management, College of Business Administration  
Rebeca Perren, Assistant Professor, Department of Marketing, College of Business Administration

#### CSM

Charles J. De Leone, Professor, Department of Physics  
Kambiz M. Hamadani, Assistant Professor, Department of Chemistry and Biochemistry  
Robert Iafe, Assistant Professor, Department of Chemistry and Biochemistry  
James Jancovich, Associate Professor, Department of Biological Sciences  
Jacqueline A. Trischman (Faculty Director), Professor, Department of Chemistry & Biochemistry

### **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<sup>TM</sup> 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      McMahan 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 troubleshoot unexpected results
3. Discuss the importance of each step in the brewing process.
4. Operate a fermenter.
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 | Evolution of Beer (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)                                   |
| ENGB 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 EngiBeer<sup>TM</sup> Certificate – 12 units

Required:

ENGB 300 (2 units)

ENGB 301 (1 units)

ENGB 310 (3 units)

ENGB 350 (3 units)

Elective – Choose one of the following:

ENGB 351 (3 units)

ENGB 400 (3 units)

ENGB 401 (3 units)

Brewing Science Certificate – 16 units\*

(Pre-requisite = Basic EngiBeer<sup>TM</sup> Certificate)

ENGB 351 (3 units)

ENGB 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 EngiBeer<sup>TM</sup> 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 (CHEM 490), but this will be graded as a separate course rather than as a means of assessing mastery of all certificate material. To earn a certificate, students must earn a C or higher in each course and have a final GPA of 3.0 or higher in the certificate overall.

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

Because all courses 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 Cicerone Program which certifies beer

professionals in much the same way as sommelier'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 EngiBeer™ I (3 units)**

First in a two-course sequence designed to familiarize students with large-scale/commercial brewing production, including equipment and techniques. Includes brewery design and layout, equipment acquisition and use, ingredients, creating and adjusting recipes, along with basic sanitation, brewery safety and legal requirements. 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 EngiBeer™ 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. *Prerequisite: ENGB 350*

### **ENGB 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 and includes discussions of polarity and pH as well the basics of functional groups in organic chemistry followed by the application of these topics to brewing. *Prerequisite: 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)**



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 Berkeley

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 EngiBeering™ (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 EngiBeering™ 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 EngiBeering™:
  - 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)

ENGB 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 EngiBeering™ 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 EngiBeering™
- 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)

ENGB 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.