



Class Schedule

Lecture: TR 3:00 pm - 4:15 pm, Jett Hall 207

Instructor

Stephen Taylor

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University-Required COVID-19 Expectation Statement

In alignment with updated guidance from the CDC (U.S. Department of Health & Human Services, Centers for Disease Control and Prevention, *Interim Public Health Recommendations for Fully Vaccinated People*. <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html>; accessed January 07, 2022) and recommendations from New Mexico Governor Michelle Lujan Grisham, masks will be required at all indoor NMSU system locations and offices around the state. This indoor mask requirement applies to all classrooms, labs, meeting rooms, vehicles and other spaces, and to all faculty, staff, students, and visitors to NMSU campuses and offices, regardless of vaccination status or social-distancing opportunities. Please be mask-ready. If you need a mask, one will be provided to you. Failure to comply with the masking requirement, after a single reminder, will result in the student's dismissal for the day.

There will be no food or drink allowed during lecture. Every student will record where he or she sat in during every lecture. Talking in the lecture hall is discouraged.

Beginning Thursday, September 30, 2021, all NMSU system students and employees at all campuses and offices have the choice to either provide proof of vaccination or proof of a weekly negative COVID-19 test.

If you test positive for COVID-19, then you must report your case to NMSU immediately through NMSU's online self-report portal at covid19.nmsu.edu/self-report. This starts the contact-tracing process. If you have been in lecture within 1 m of anyone who tested positive, then you will at least need to be tested for COVID-19. For further questions about COVID, e-mail covid19@nmsu.edu.

For further information, please see NMSU Now, *Our dynamic pandemic action plan, Key updates and quick-reference*. <https://now.nmsu.edu/plan/key-updates-and-quick-reference.html>; accessed January 07, 2022).

The Crimson Commitment

Please read the *Crimson Commitment* and acknowledge the Crimson Commitment video by logging in to myNMSU.

As an Aggie, I commit to

Personally protecting my own health	<ul style="list-style-type: none"> • Monitor myself for symptoms of COVID-19 • Report to the Aggie Health & Wellness Center or other medical professional if I experience ANY of the following <ul style="list-style-type: none"> ○ A fever of 38 °C (100.4 °F) or higher ○ A dry cough ○ Difficulty breathing ○ Chills ○ Repeated shaking with chills ○ Muscle pain ○ Headache ○ Sore throat ○ Loss of taste or smell • Wash my hands often with soap and water and/or use hand sanitizer • Get vaccinated for the flu during the fall semester
Protecting other Aggies	<ul style="list-style-type: none"> • Wear an appropriate face covering and other protective gear as directed in the NMSU Ready Plan • Maintain appropriate social distancing, especially in classroom settings • Stay home if I feel ill or after exposure to someone who is ill or someone who has tested positive for COVID-19 • Be positive, attentive, and helpful to anyone around who may be in need of support
Keeping the Aggie Community Safe	<ul style="list-style-type: none"> • Keep my belongings, personal spaces, and shared common spaces clean • Participate in testing and contact tracing to preserve the wellness of the community • Carefully observe instructional signs and follow directions and requests of University officials

Catalog Description – 3 credits lecture

Details of beer production, fermentation science, brewery operation, and process design & economics. Engineering considerations including process safety, fermentation kinetics, unit operations, and economies of scale. Beer styles, recipe formulation, product quantification for tax purposes, and brew analytical methods will also be discussed.

Cross-listed with FSTE 430 and FSTE 532 with some differentiated assignments.

Students enrolled in CHME 495 also typically enroll in CHME 495L.

Prerequisites

- CHME 441, CHME 452, or permission of instructor; CHME 395V recommended.
- Each student must submit (upload to Canvas) a photo of a valid ID, with a clearly visible birthdate, by the end of the day on Tuesday, January 18. Failure to comply will result in being permanently dropped from the course.

Textbook (required)

- *Brewing Science: A Multidisciplinary Approach*, by Michael Mosher and Kenneth Trantham, Springer, 2016 (ISBN 978-3319463933).
- Additional materials available on Canvas.

Textbooks (recommended for those with long-term brewing interests)

- *Brewing Elements* four-book series:
 - *Yeast: The Practical Guide to Beer Fermentation* by Chris White and Jamil Zainasheff, Brewers Publications, 2010 (978-0937381960).
 - *For the Love of Hops* by Stan Hieronymus, Brewers Publications, 2012 (ISBN 978-19384690105).
 - *Water: A Comprehensive Guide for Brewers* by John Palmer and Colin Kaminski, 2013 (ISBN 978-0937381991).
 - *Malt: A Practical Guide from Field to Brewhouse* by John Mallett, Brewers Publications, 2014 (ISBN 978-1938469121).
- *Handbook of Brewing: Processes, Technology, Markets* by Hans Michael Eßling, Wiley-VCH, 2009 (ISBN 978-3527316748).
- *Technology: Brewing and Malting, 5th Revised English Edition* by Wolfgang Kunze, VLB Berlin, 2014 (ISBN 978-3921690772)

Course Objectives

By the end of the lecture components of the course, students will be able to:

- Describe the brewing and beer context for brewery locations.
- Create a brewery business plan, incorporating regulatory considerations.
- Create and modify a beer recipe based on style, cost, and complexity.
- Manage an ingredient inventory appropriate for size and style of brewery.
- Describe the characteristics of brewing ingredients.
- Manage safety considerations and engineering controls for brewery operations.
- Practice safe alcohol service and consumption.
- Identify information and advice resources within the brewing industry.
- Select brewing equipment and processing conditions for milling, mashing, sparging, boiling, fermenting, conditioning/aging, and packaging/storing.
- Evaluate and/or troubleshoot beer using sensory evaluation terms and tools.
- Size and cost brewery unit operations, processes, ingredients, and utilities.

Organization of the Course

This course is built around five learning modules that focus on the knowledge and skills needed by an engineer within a brewery. Note that we will not follow the textbook in sequence.

- Context of brewing
 - Where, when, how, and why beer developed
 - Brewing's relationship to chemistry and chemical engineering
- Brewing ingredients: grains, water, hops, adjuncts
 - Malting
 - Biochemistry
 - Water chemistry
 - Recipe development
- Brewing process – What *brewers* do
 - Milling, treating water, mashing, sparging
 - Boiling, cooling, and fining
- Fermentation and maturation – What *yeast* does
 - Biology and biochemistry
 - Competing microorganisms: cleaning and sanitation
 - Flavors and off-flavors

- Finished beer logistics
 - Packaging: kegging, bottling, and canning
 - Storage, aging, and stability
 - Distribution
- Brewing context revisited
 - Marketing
 - Brewery vision – styles and R&D

New Mexico Alcohol Servers License

All students will obtain a New Mexico (or their home state) alcohol server permit as part of the course learning objectives: <https://www.servsafe.com/ServSafe-Alcohol>. To receive credit, student must present a copy of their license by the end of the day on Friday, March 25.

Brewers Association Online Safety Trainings

All students will complete the 14 free online safety training modules offered by the Brewers Association. To receive credit for completing the training, students need to submit pdf files/screenshots of their certificates through Canvas by the end of the day on March 25. Modules can be accessed through: <https://www.brewersassociation.org/educational-publications/free-online-brewery-safety-training/>

Beer and Food Tasting Assignments

Understanding beer and food require experiential learning that engage the senses. In a typical semester, we accomplish this through sampling beers and foods in class and during brewery visits. For this semester, we will have beer and food tasting assignments to provide experience for food-beer pairings required for the Brewery Business Plans. For each of six foods, students will try three different beer styles with that food. They will describe the food and each of the beers, and justify why one of the beer styles is the best pairing for that food. A given beer style can be used up to twice.

End-of-Module Assessments

We will not have a final written exam. Instead, we will have written and/or practical assessments of the learning objectives at the end of each module, with the first “module” being assessed at the end of the course through the business plans. These will be done as take-home assignments with follow-on individual discussion with the instructor(s) to clarify answers and review concepts.

Brewery Business Plans

Each team (including a mix of students from CHME 495 and FSTE 430) will design a business plan for a new brewpub to be located in El Paso. Business plans will include descriptions of the location and space, beer recipes, overall brewpub theme, food menu, specifications (with part numbers and manufacturers) of equipment, estimated capital and operating costs, and feasibility evaluation. These will be due before class during the final exam week. More details will be provided through Canvas.

Assessment

Individual (70%):

Class preparation quizzes	15%
Required external trainings	10%
Beer/food tasting assignments	15%
End-of-module assessments	30%

Team (30%):

Brewery business plan (by rubric)	20%
Team contribution	10%

Team contribution will be determined by peer evaluation. Individuals will evaluate the contributions their team members by assigning an average of 10 points to the other team members. For example, members of a 5-person team, split 40 points between the other 4 members, and must give at least one score >10 and at least one score <10. Team contribution scores will be the average of the grades (out of 10) received. A “practice” team contribution evaluation will be done at mid-term so that students can receive feedback. We will give all students a midterm grade estimation before March 25.

Safety Valves

The lowest two individual quiz grades will be dropped. Each student will be allowed to revise one end-of module assessment to earn back up to 50% of points missed.

Common Syllabus Addendum

Additional policies can be found in the Chemical & Materials Engineering Department’s common syllabus addendum: <http://chme.nmsu.edu/academics/syllabi/chme-common-syllabus-addendum/>.

Syllabus Preparation Date: 2/15/23