

Ogden College of Science and Engineering
Western Kentucky University
Office of the Dean
745-6371

REPORT TO THE GRADUATE COUNCIL COMMITTEE

DATE: December 9, 2015

FROM: Ogden College of Science and Engineering

Ogden College of Science and Engineering Committee Members: Dr. Fred DeGraves, Dr. John Khouryieh, Dr. Michael Smith, Dr. Eric Conte, Dr. Zhonghang Xia, Dr. Shane Palmquist, Dr. David Keeling, Dr. Ferhan Atici, Dr. Sanju Gupta, Dr. Sharon Mutter

Chair: Dr. Cathleen Webb

The Ogden College of Science and Engineering submits the following items for consideration at the September meeting:

Action	Proposal to Create a New Course BDAS 500, The Science of Fermenting in Brewing and Distilling Contact Person, Cathleen Webb, cathleen.webb@wku.edu , 5-6181
Action	Proposal to Create a New Course BDAS 595, Internship in Brewing/Distilling Contact person, Cathleen Webb, cathleen.webb@wku.edu , 56181
Action	Proposal to Create a New Certificate Program Brewing and Distilling Arts & Sciences Contact Person, Cathleen Webb, cathleen.webb@wku.edu , 5-6181
Action	Proposal to Revise a Course CHEM 412G, Introduction to Physical Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 420G, Inorganic Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 425G, Polymer Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 435G, Instrumental Analysis Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 440G, Introduction to Synthetic Organic Methodology Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019

Action	Proposal to Revise a Course CHEM 470G, Chemistry/Middle School Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 476G, Advanced Laboratory Investigations in Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 490G, Materials Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 491G, Materials Chemistry Laboratory Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 520, Advanced Inorganic Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 531, Advanced Analytical Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 5341, Advanced Organic Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 550, Advanced Physical Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 570, Lecture Demonstration Techniques Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 590, Material Chemistry Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019
Action	Proposal to Revise a Course CHEM 591, Material Chemistry Laboratory Contact Person, Eric Conte, eric.conte@wku.edu , 5-6019

Members Present: Dr. Fred DeGraves, Dr. John Khouryieh, Dr. Michael Smith, Dr. Eric Conte, Dr. Zhonghang Xia, Dr. Shane Palmquist, Dr. David Keeling, Dr. Ferhan Atici, Dr. Sanju Gupta, Dr. Sharon Mutter

Dr. Cathleen Webb, Chair

Meeting was held via email.

OLD BUSINESS

The minutes from August and September and October were approved.

NEW BUSINESS

No Consent Items

Action Items

Palmquist/Keeling made a motion to bundle and approve. Motion Approved

PSYS 423G

PSYS 424G

PSYS 453G

The items below are from the October 23rd Agenda, they have been included on the current minutes because they will be sent to the Graduate Council Curriculum Sub-Committee with the November Agenda.

Consent Item

Mutter/Keeling made a motion to move the consent item (Proposal to Create a New Course, BDAS 595, Internship in Brewing/Distilling) to an action item. Motion approved.

Action Items

Mutter/Keeling moved to bundle the following items and re-introduce them at the next meeting with suggested amendments.

BDAS 595

BDAS 500

Proposal to Create a New Certificate Program

Keeling DeGraves made a motion to bundle and approve. Motion unanimously approved.

BIOL 400G

BIOL 407G

BIOL 446G

BIOL 447G

BIOL 450G

BIOL 456G

BIOL 459G

BIOL 460G
BIOL 464G
BIOL 467G
BIOL 495G

Keeling/Mutter made a motion to approve. Motion unanimously approved.
BIOL 526

Keeling/Khouryieh made a motion to approve. Motion unanimously approved.
Proposal to Add a New Master's Degree Program, Mathematical Economic MS Program

**Ogden College of Science and Engineering
Potter College of Arts & Letters
Department: Dean's Office
Proposal to Create a New Course
(Action Item)**

Contact Person: Rodney King, rodney.king@wku.edu, 5-6910
Cathleen Webb, cathleen.webb@wku.edu, 5-6181
Andrew McMichael, andrew.mcmichael@wku.edu, 5-6538

1. Proposed course:

- 1.1 Course prefix (subject area) and number: BDAS 500
- 1.2 Course title: The Science of Fermentation in Brewing and Distilling
- 1.3 Abbreviated course title: Fermentation Science
(maximum of 30 characters or spaces)
- 1.4 Credit hours: 3
- 1.5 Variable credit (yes or no): No
- 1.6 Repeatable: no
- 1.7 Grade type: Standard Letter Grade
- 1.8 Prerequisites: Graduate Status
- 1.9 Corequisites: None
- 1.10 Course description: : Introduction to the basic scientific principles that govern the fermentation process, with particular application to brewing and distilling.
- 1.11 Course equivalency: None

2. Rationale:

- 2.1 Reason for developing the proposed course:
The science of zymology is foundational to the understanding of biology and chemistry. It also forms the basis for industries as diverse as brewing and distilling, fuel production, food manufacturing, and the manufacture of chemical and biological weapons. Students who wish to understand a wide range of applications for biology and chemistry must understand the principles of fermentation.

Currently, several courses in the Departments of Chemistry and Biology cover some of the basic principles of fermentation. These include BIOL 226/227, which examines morphological, cultural, and biochemical characteristics of important groups of bacteria. BIO/CHEM 446, BIO/CHEM 447, BIO/CHEM 467 address biochemical compounds and their role in intermediary metabolism (including fermentation), enzyme activity and energetics.

However, none of these classes focus specifically on the principles of fermentation. The creation of this class will provide students with a focused, intensive study of fermentation, which will better prepare them for other courses in their fields. The particular focus here is on the brewing and distilling industries, which are a fast-growing segment of the economy of Kentucky and the United States. This course will therefore also give students a focused study in

an area critical to workforce development.

This course will also serve as a foundational course for the certificate, minor, and major in Brewing and Distilling Arts & Sciences that is currently under development.

- 2.2 Relationship of the proposed course to other courses at WKU:
Some similar content is covered in BIO/CHEM 562 which addresses biochemical compounds and their role in intermediary metabolism (including fermentation), enzyme activity and energetics. However, this new course focuses exclusively on fermentation microbiology and will serve as a foundation for the certificate, minor or major in the WKU BDAS program.
- 2.3 Relationship of the proposed course to courses offered in other departments:
There is currently no similar process-oriented course that focuses exclusively on the microbiology of fermentation.
- 2.4 Relationship of the proposed course to courses offered in other institutions:
A number of our benchmark institutions offer undergraduate courses with similar content. However, none of these programs teach courses in conjunction with a corporate partner. In addition, the brewing science programs offered at these benchmarks tend to be exclusively science-focused, without the integration of science, arts, and humanities.

Appalachian State offers a Fermentation Sciences Program. Their Principles of Fermentation Sciences (FER1000; 3 credits) covers the history, culture, and fundamental science of the fermentation processes, basic food science, microbiology, chemistry, biology, natural products chemistry and nutrition. Students are exposed to the basic methods and principles behind the fermentation process including production of cheese, bread, vegetables, meats, beer, wine, bio-fuels and distilled products. An upper level course, Brewing Science and Analysis (FER 4200, 4 credits), covers the chemical and physical processes that go into brewing malted beverages, including the choice of the hops, malt, and yeast varieties and how they are combined to produce specific styles and flavors of beers. Flavor and aroma compounds are quantified by students.

Central Michigan University's Fermentation Program is offered through the College of Science and Technology: It is a 16-credit-hour Undergraduate Certificate designed for degree seeking students of any major and non-degree-seeking students who want to understand the science and technology involved in brewing craft beer. It is designed to prepare students for entry or advancement in the brewing industry or advanced studies in fermentation science or food science. Their Applied Fermentation Science 3 (SCI 322; 1-5 credits) course is a practical application of fermentation science principles in the production and analysis of beer and their Fundamentals of Fermentation Science (SCI 320; 3 credits) focuses on the biochemistry and microbiology involved in the process of brewing beer.

Eastern Kentucky University has a new Fermentation Program. Their Fermentation Microbiology course (FMT 540; 3 credits) focuses on the biochemistry, genetics, and behavior of microorganisms for the production of fermented beverages. In their Fermentation Project Lab. (FMT 549; 2 credits) students perform an independent capstone project where they decide on the process to make a final fermentation product.

Ohio University offers a Brewing Science course called “The Principles of Brewing Science” (CHEM 4501; 3 credits) which aims to demonstrate fundamental principles and concepts of biochemistry, physiology, microbiology, and plant biology through beer brewing.

A number of benchmark schools including Central Michigan, Ball State, Middle Tennessee State, Northern Illinois and Southern Mississippi offer courses in Applied and Environmental Microbiology. These are generally upper level, 3 credit hour courses that cover the microbiology of food, milk, water, sewage, and soils and the fundamentals of environmental and industrial microbiological applications. None of these courses focus exclusively on fermentation microbiology and its application to brewing and distilling.

3. Discussion of proposed course:

3.1 Schedule type: C

3.2 Learning Outcomes:

- Explain the brewing process.
- Use common brewing equipment and reagents safely and successfully
- Explain the purpose of each step in the brewing process and identify potential steps where unwanted bacterial and or yeast contamination could be introduced.
- Learn to culture bacteria and yeast
- Formulate brewing plan, generate, record and organize brewing data (using tables, diagrams and drawings as appropriate), analyze and interpret the data, and draw logical conclusions based upon collected data and the final fermented product.
- Identify and describe different yeast types
- Identify, Describe and Differentiate between bacterial cells and yeast cells
- Describe and differentiate between bacterial growth and yeast growth
- Describe parameters that affect the growth of microorganisms
- Describe ways to control the growth of microorganisms
- Explain different sanitization techniques and apply these techniques to in-class brewing projects
- Discuss the overall scientific contributions of Louis Pasteur and his particular contributions to fermentation science
 - Content outline:
 - History of Fermentation
 - Contributions of Louis Pasteur
 - Microbiological Principles
 - Aseptic technique
 - Sterility vs Disinfection vs Sanitization vs Antiseptics
 - Safe handling of microbes
 - Proper disposal of bio-hazardous waste
 - Features of microbial cells
 - Bacteria vs Yeast
 - Types of bacteria and their impact the brewing process
 - Types of yeast and their impact of the brewing process
 - Bacterial nutrition and growth
 - Culturing bacteria and yeast
 - Parameters that affect microbial growth

- Antimicrobial properties of Hops
 - Microscopy
 - Basic principles of microscopy
 - Cellular morphology of bacterial and yeast cells
 - Biochemistry of Fermentation
 - Cellular Metabolism
 - Basic enzymology
 - How is cellular energy generated?
 - Brewing projects
 - Evaluate the effect of different Hops additions
 - Evaluate the effect of different yeast strains
 - Set up and maintenance of research notebook
 - Presentation of scientific data
- Student expectations and requirements: Proper laboratory notebook maintenance, exams to measure content mastery, brewing projects
- Tentative texts and course materials:

Materials will vary from semester to semester. Among the standard texts in the field are:

 - Pasteur and Modern Science (Dubos, ASM press; ISBN 1555811442),
 - The complete Joy of Homebrewing (Papazian, Harper Collins; ISBN 0060531053)
 - Brewing Microbiology (Springer: ISBN-13: 978-1461348580)
 - Yeast: The Practical Guide to Beer Fermentation (Brewers Association; ISBN-10: 0937381969)
 - Bamforth, Charles. *Beer: Tap Into the Art and Science of Brewing*. (New York: Oxford University Press, 2009)
 - Fix, George. *Principles of Brewing Science: A Study of Serious Brewing Issues*. (Boulder, Co.: Brewers Publications, 1999)
 - Palmer, John and Kaminski, Colin. *Water: A Comprehensive Guide for Brewers*. (Boulder, Co.: Brewers Publications, 2013)
 - Rogers, Adam. *Proof: The Science of Booze* (Boston: Houghton Mifflin, 2014)
 - Russell, Inge, and Stewart, Graham, eds. *Whisky: Technology, Production, and Marketing*. (Boston: Elsevier, 2014).

4. Budget implications:

- 4.1 Proposed method of staffing: Current staffing is sufficient.
- 4.2 Special equipment, materials, or library resources needed: None beyond what is already available.

5. Term for implementation: Spring 2016

6. Dates of committee approvals:

Department of Agriculture	11/20/15
College Curriculum Committee	_____
Professional Education Council (if applicable)	_____
Graduate Council	_____

University Senate

***New course proposals require a Course Inventory Form be submitted by the College Dean's office to the Office of the Registrar.*

Create a New Course (Action)

Date: 23 October 2015

College: Ogden College of Science and Engineering, Potter College of Arts & Letters

Department: Deans' Offices, OCSE Agriculture

Contact Person: Cathleen Webb, cathleen.webb@wku.edu, 5-6181;

Andrew McMichael, andrew.mcmichael@wku.edu, 5-6538

1. Proposed course:

- 1.1 Course prefix (subject area) and number: BDAS 595
- 1.2 Course title: Internship in Brewing/Distilling
- 1.3 Abbreviated course title: Brewing/Distilling Internship
- 1.4 Credit hours: 3-6
- 1.5 Variable credit (yes or no): No
- 1.6 Repeatable (yes or no) for total of 6 hours:
- 1.7 Grade type: Standard Letter
- 1.8 Prerequisites: Consultation with a designee of the Ogden College or Potter College Dean's office.
- 1.9 Corequisites: None
- 1.10 Course description: On-site experience in a brewery or distillery, conducted under the supervision of the program coordinator and local personnel. Experience could include but is not limited to brewing, distilling, marketing, management, or other industry-related work. Can be repeated for up to six credit hours.
- 1.11 Course equivalency: None

2. Rationale:

2.1 Reason for developing the proposed course: The craft brewing and distilling industries are a fast-growing segment of the U.S. and Kentucky economies. Brewing and distilling contributes an annual payroll of around \$250 million each, with a direct economic impact—including retail, tourism such as the Bourbon Trail, and associated industries such as agriculture, construction, and manufacturing—of more than two billion dollars. Kentucky alone employs more than three hundred people in breweries and thousands more in brewing-related jobs, while the distilling industry employs more than three thousand in distilleries and thousands more in related jobs.

This course helps meet a workforce need in the Commonwealth and in the United States by placing students into a fast-growing segment of the economy, while at the same time providing an atmosphere in which students in various majors can gain valuable hands-on experience.

Over the past year we have gotten many requests from students and from people in the brewing and distilling industries to help with internship placements. Having an internship course specific to the industry will help students once they enter the job market.

2.2 Relationship of the proposed course to other courses at WKU: None

3. Discussion of proposed course:

- 3.1 Schedule type: N
- 3.2 Learning Outcomes: By the end of the course, students should be able to
 - Apply knowledge from their major/minor/certificate field to the brewing and distilling industry.
 - Understand how their major/minor/certificate field relates to the brewing and/or distilling industries on a practical level.
- 3.3 Content outline:
 - Under the supervision of a major professor and/or a designee of the Ogden College or Potter College Dean's office, the student will apply his/her knowledge to assignments of value within the brewing or distilling industry.

- Students will write a final essay analyzing their experience within the context of what they had learned in their major/minor/certificate field.
- Students will conduct directed research within the scope of their internship assignment, and produce a final research product at the end of their internship.

3.4 Student expectations and requirements: Students will apply for an internship through one of their major/minor/certificate professors, or a designee of the Ogden College or Potter College Dean’s office. If the application comes through a major/minor/certificate professor, that professor will work with a designee of the Ogden College or Potter College Dean’s office to help the student review and understand the internship policies as outlined by the Career Services Center. The student will complete a learning plan that will be approved by the faculty supervisor and/or a designee of the Ogden College or Potter College Dean’s office, and a supervisor from the cooperating organization. An end-of-internship evaluation of the student’s performance will come from the organization’s supervisor. The student will also consult with, and design, a graduate-level research project related to the nature of his/her internship placement. The faculty advisor will assign a grade based on the supervisor’s report and the student’s final essay and research project.

3.5 Tentative texts and course materials: Will vary based on the placement.

4. Budget implications:

4.1 Proposed method of staffing: One of the co-directors, or a faculty member in the students’ major field, will supervise and evaluate the student’s internship in conjunction with the employer.

4.2 Special equipment, materials, or library resources needed: None

5. Term for implementation: Spring 2016

6. Dates of committee approvals:

Department of Agriculture	11/20/15
College Curriculum Committee	_____
Professional Education Council (if applicable)	_____
Graduate Council	_____
University Senate	_____

***New course proposals require a Course Inventory Form be submitted by the College Dean’s office to the Office of the Registrar.*

Certificate Program - Create New (Information)

Date: 25 Sept. 2015

College: Ogden College of Science and Engineering, Potter College of Arts & Letters

Department: Deans' Offices

Contact Person: Cathleen Webb, cathleen.webb@wku.edu, 5-6181;

Andrew McMichael, andrew.mcmichael@wku.edu, 5-6538

1. Identification of program:

1.1 Program title: Brewing and Distilling Arts & Sciences

1.2 Required hours: 13.5-16.5

1.3 Program Description:

Humans have been brewing alcohol since the dawn of recorded history, and distilling stretches back over a thousand years. Brewing and distilling play a major role in the Kentucky and U.S. economy. Industries as diverse as farming, tourism, construction, and retail all rely on, and contribute to alcohol production.

This multidisciplinary graduate certificate is designed to complement an existing major in a related field, by providing a background understanding of topics related to the brewing and distilling industries—the science, the business, and the history, as well as an internship—students need to become competitive in the marketplace.

Students will take four courses for the certificate. BDAS500 is an intensive introductory study of the science of fermentation. BA502 is a series of online modules designed to introduce the student to marketing, accounting, finance, management, and business math. HIST531 examines the history of brewing and distilling, and BDAS595 is a variable-credit internship placement in a sector of the brewing and distilling industry, in consultation with a faculty supervisor.

1.4 Classification of Instructional Program Code (CIP):

2. Learning outcomes of the proposed certificate program:

Upon completion of this certificate students should

- Have a basic familiarity with the brewing and distilling industries, including the underlying science, the management and business, and history;
- Have experience, through an internship, in a distillery or brewery.

3. Rationale:

3.1 Reason for developing the proposed certificate program:

The craft brewing and distilling industries are a fast-growing segment of the U.S. and Kentucky economies. Brewing and distilling contributes an annual payroll of around \$250 million each, with a direct economic impact—including retail, tourism such as the Bourbon Trail, and associated industries such as agriculture, construction, and manufacturing—of more than two billion dollars. Kentucky alone employs more than three hundred people in breweries and thousands more in brewing-related jobs, while the distilling industry employs more than three thousand in distilleries and thousands more in related jobs. Currently, WKU offers no options that meet workforce needs associated with the brewing and distilling industries, and employers (even those in-state) look to interns and skilled employees from outside the state to meet their workforce needs.

Brewing certificates are becoming increasingly popular at universities around the country, and a

few certificates in distilling have begun to crop up. The majority of these are at two-year colleges or extension campuses of existing four-year universities. Virtually all of the certificates are located in the sciences—either food sciences or chemistry of one kind or another.

In informal surveys of distilleries and breweries around the country and in Kentucky, brewers and distillers consistently stated that they wished they had had, and that they wanted new employees to have, a broad base of skills. Those surveys, conducted in 2010 and 2014 showed that industry employers wanted graduates with an education that spanned multiple disciplines, including the arts, the sciences, the humanities, business, and the health sciences fields.

This graduate certificate will give students a background in the fundamentals of the brewing and distilling industries—the science, the business, and the history, as well as an internship—they need to become competitive in the marketplace. The certificate does so by providing a traditional, broad-based liberal arts and sciences education that speaks to the core mission of WKU.

Relationship of the proposed certificate program to other programs now offered by the department:
None

3.2 Relationship of the proposed certificate program to certificate programs offered in other departments: Many departments offer graduate certificates. This was modeled on a standard 12-15 hour requirement, with extra hours allowed for extended or repeated internships. The Department of Communication offers a 12-hour Communicating in Healthcare Certificate; The Department of Philosophy and Religion offers a 15-hour Religious Studies Certificate; The School of Teacher Education offers a 15-hour Certificate in Autism Spectrum Disorders. Many others exist. No other unit offers one focus on brewing and distilling.

3.3 Projected enrollment in the proposed certificate program: 3-5 per year, based on student interest and inquiries from industry partners to place employees in graduate programs.

3.4 Similar certificate programs offered elsewhere in Kentucky and in other states (including programs at benchmark institutions): While undergraduate certificates in brewing proliferate, no other Kentucky institution offers one at the graduate level. Auburn University offers a graduate certificate in Brewing Science and Operations through their Nutrition, Dietetics, & Hospitality Management program. The University of California at Davis also offers a Masters Brewing Program. This is not the same as a certificate in that it is meant to prepare a student to take an intensive, internationally-recognized professional examination. Our interviews with brewers and industry leaders suggests that this type of program is not as useful as what we propose.

3.5 Relationship of the proposed certificate program to the university mission and objectives: This program speaks to the part of the university mission that looks to “[prepare] students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society.” The Certificate in Brewing and Distilling Arts & Sciences speaks to workforce needs, and engages students in an important component of American culture, history, technology, science, and economy. The interdisciplinary nature speaks to the nature of a university—to prepare students to enter the workforce with an education that comes from a wide variety of subjects that reinforces and goes beyond what they would get by simply taking their general education classes.

4. Admission Criteria:

5. Curriculum:

Course Title	CR
BDAS 500—The Science of Fermentation in Brewing, and Distilling	3

BA 502—MBA Foundations (online)	4.5
HIST 531—The Cultural History of Alcohol (available online)	3
BDAS 595—Internship in Brewing and Distilling	3-6
Total	13.5-16.5

6. **Budget implications:** None. This certificate requires no additional faculty, nor any additional material resources.

7. **Term of implementation:** Spring 2016

8. **Dates of committee approvals:**

Department

College Curriculum Committee

Office of Academic Affairs (if ≥ 18 hour program)

Professional Education Council (if applicable)

Graduate Council

University Senate

Board of Regents

Certificate Program - Create New (Action)

Date: 23 October 2015

College: Ogden College of Science and Engineering, Potter College of Arts & Letters

Department: Deans' Offices

Contact Person: Cathleen Webb, cathleen.webb@wku.edu, 5-6181;

Andrew McMichael, andrew.mcmichael@wku.edu, 5-6538

1. Identification of program:

1.1 Program title: Brewing and Distilling Arts & Sciences

1.2 Required hours: 13.5-16.5

1.3 Program Description:

Humans have been brewing alcohol since the dawn of recorded history, and distilling stretches back over a thousand years. Brewing and distilling play a major role in the Kentucky and U.S. economy. Industries as diverse as farming, tourism, construction, and retail all rely on, and contribute to alcohol production.

This multidisciplinary graduate certificate is designed to complement an existing major in a related field, by providing a background understanding of topics related to the brewing and distilling industries—the science, the business, and the history, as well as an internship—students need to become competitive in the marketplace.

Students will take four courses for the certificate. BDAS500 is an intensive introductory study of the science of fermentation. BA502 is a series of online modules designed to introduce the student to marketing, accounting, finance, management, and business math. HIST531 examines the history of brewing and distilling, and BDAS595 is a variable-credit internship placement in a sector of the brewing and distilling industry, in consultation with a faculty supervisor.

1.4 Classification of Instructional Program Code (CIP):

2. Learning outcomes of the proposed certificate program:

Upon completion of this certificate students should

- Have a basic familiarity with the brewing and distilling industries, including the underlying science, the management and business, and history;
- Have experience, through an internship, in a distillery or brewery.

3. Rationale:

3.1 Reason for developing the proposed certificate program:

The craft brewing and distilling industries are a fast-growing segment of the U.S. and Kentucky economies. Brewing and distilling contributes an annual payroll of around \$250 million each, with a direct economic impact—including retail, tourism such as the Bourbon Trail, and associated industries such as agriculture, construction, and manufacturing—of more than two billion dollars. Kentucky alone employs more than three hundred people in breweries and thousands more in brewing-related jobs, while the distilling industry employs more than three thousand in distilleries and thousands more in related jobs. Currently, WKU offers no options that meet workforce needs associated with the brewing and distilling industries, and employers (even those in-state) look to interns and skilled employees from outside the state to meet their workforce needs.

Brewing certificates are becoming increasingly popular at universities around the country, and a

few certificates in distilling have begun to crop up. The majority of these are at two-year colleges or extension campuses of existing four-year universities. Virtually all of the certificates are located in the sciences—either food sciences or chemistry of one kind or another.

In informal surveys of distilleries and breweries around the country and in Kentucky, brewers and distillers consistently stated that they wished they had had, and that they wanted new employees to have, a broad base of skills. Those surveys, conducted in 2010 and 2014 showed that industry employers wanted graduates with an education that spanned multiple disciplines, including the arts, the sciences, the humanities, business, and the health sciences fields.

This graduate certificate will give students a background in the fundamentals of the brewing and distilling industries—the science, the business, and the history, as well as an internship—they need to become competitive in the marketplace. The certificate does so by providing a traditional, broad-based liberal arts and sciences education that speaks to the core mission of WKU.

Relationship of the proposed certificate program to other programs now offered by the department: None

3.2 Relationship of the proposed certificate program to certificate programs offered in other departments: Many departments offer graduate certificates. This was modeled on a standard 12-15 hour requirement, with extra hours allowed for extended or repeated internships. The Department of Communication offers a 12-hour Communicating in Healthcare Certificate; The Department of Philosophy and Religion offers a 15-hour Religious Studies Certificate; The School of Teacher Education offers a 15-hour Certificate in Autism Spectrum Disorders. Many others exist. No other unit offers one focus on brewing and distilling.

3.3 Projected enrollment in the proposed certificate program: 3-5 per year, based on student interest and inquiries from industry partners to place employees in graduate programs.

3.4 Similar certificate programs offered elsewhere in Kentucky and in other states (including programs at benchmark institutions): While undergraduate certificates in brewing proliferate, no other Kentucky institution offers one at the graduate level. Auburn University offers a graduate certificate in Brewing Science and Operations through their Nutrition, Dietetics, & Hospitality Management program. The University of California at Davis also offers a Masters Brewing Program. This is not the same as a certificate in that it is meant to prepare a student to take an intensive, internationally-recognized professional examination. Our interviews with brewers and industry leaders suggests that this type of program is not as useful as what we propose.

3.5 Relationship of the proposed certificate program to the university mission and objectives: This program speaks to the part of the university mission that looks to “[prepare] students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society.” The Certificate in Brewing and Distilling Arts & Sciences speaks to workforce needs, and engages students in an important component of American culture, history, technology, science, and economy. The interdisciplinary nature speaks to the nature of a university—to prepare students to enter the workforce with an education that comes from a wide variety of subjects that reinforces and goes beyond what they would get by simply taking their general education classes.

4. Admission Criteria:

5. Curriculum:

Course Title	CR
BDAS 500—The Science of Fermentation in Brewing and Distilling	3

BA 502—MBA Foundations (online)	4.5
HIST 531—The Cultural History of Alcohol (available online)	3
BDAS 595—Internship in Brewing and Distilling	3-6
Total	13.5-16.5

6. **Budget implications:** None. This certificate requires no additional faculty, nor any additional material resources.

7. **Term of implementation:** Summer 2016

8. **Dates of committee approvals:**

Department (Agriculture)	11/20/15
College Curriculum Committee	_____
Office of Academic Affairs (if ≥18 hour program)	_____
Professional Education Council (if applicable)	_____
Graduate Council	_____
University Senate	_____
Board of Regents	_____

**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 412G
- 1.2 Course title: Introduction to Physical Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

College Graduate Curriculum Committee

Graduate Council

University Senate

**Course revision proposals require a Course Inventory Form be submitted by the College Dean's office to the Office of the Registrar.*

**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 420G
- 1.2 Course title: Inorganic Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

College Graduate Curriculum Committee

Graduate Council

University Senate

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 425G
- 1.2 Course title: Polymer Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

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University Senate

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 435G
- 1.2 Course title: Instrumental Analysis

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

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College Graduate Curriculum Committee

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 440G
- 1.2 Course title: Introduction to Synthetic Organic Methodology

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

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5. Dates of committee approvals:

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 470G
- 1.2 Course title: Chemistry/Middle School

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

College Graduate Curriculum Committee

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 476G
- 1.2 Course title: Advanced Laboratory Investigations in Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

College Graduate Curriculum Committee

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 490G
- 1.2 Course title: Materials Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

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College Graduate Curriculum Committee

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 491G
- 1.2 Course title: Materials Chemistry Laboratory

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

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11/20/2015

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 520
- 1.2 Course title: Advanced Inorganic Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

College Graduate Curriculum Committee

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 531
- 1.2 Course title: Advanced Analytical Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

Department

11/20/2015

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 541
- 1.2 Course title: Advanced Organic Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

Fall 2016

5. Dates of committee approvals:

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 550
- 1.2 Course title: Advanced Physical Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

4. Term of implementation:

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5. Dates of committee approvals:

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

1.1 Course prefix (subject area) and number: CHEM 570

1.2 Course title: Lecture Demonstration Techniques

2. Proposed change(s):

2.1 course number:

2.2 course title:

2.3 credit hours:

2.4 grade type:

2.5 prerequisites: All prerequisites have been removed.

2.6 corequisites:

2.7 course description:

2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

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Fall 2016

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 590
- 1.2 Course title: Material Chemistry

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

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**Revise a Course
(Action)**

Date: 11/9/2015

College, Department: Ogden, Chemistry

Contact Person: Eric Conte, eric.conte@wku.edu, 270-745-6019

1. Identification of course

- 1.1 Course prefix (subject area) and number: CHEM 591
- 1.2 Course title: Material Chemistry Laboratory

2. Proposed change(s):

- 2.1 course number:
- 2.2 course title:
- 2.3 credit hours:
- 2.4 grade type:
- 2.5 prerequisites: All prerequisites have been removed.
- 2.6 corequisites:
- 2.7 course description:
- 2.8 other:

3. Rationale for revision of course:

Each academic institution has its own unique course number for a given course. Therefore, WKU undergraduate prerequisite course numbers cannot be required for graduate students matriculating from other Universities or Colleges. The chemistry graduate committee will evaluate undergraduate transcripts for readiness to take this course.

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