

Wine Chemistry and Analysis (3 credits)

Hort 499 - Fall - 2016

Lecture: Monday/Wednesday 1:10-2:00 pm; WSC 201

Lab: TBA; WSC Chem lab

Contact: Dr. Tom Collins: 509-372-7515; tom.collins@wsu.edu; WSC 239A

Dr. James Harbertson; 509-752-7506; jfharbertson@wsu.edu; WSC 239C

Prerequisite: Organic chemistry (Chem 345) or its equivalent

Course Description and Objectives: This course is developed to provide the student with wine laboratory concepts, practices and procedures in fundamental and more advanced principles of analytical chemistry as they relate to winemaking. Laboratory exercises will provide hands on experience with various wet-chemical, physical, enzymatic and demonstrations of more advanced chromatographic methods. Data will be analyzed and results interpreted in lab reports. Enrollment will first be given to students in viticulture & enology; others by approval of instructors.

Learning Outcomes: Analyses of a practical and useful nature are chosen for the laboratory exercises demonstrating various chemical, physical and biochemical methods from basic wet chemistry to advanced chromatographic analyses. It is our intention that this compendium of procedures and laboratory assignments will serve the need of the student/wine manager well after the completion of this analysis course, especially in lab data interpretation and quality control. An additional outcome for this course is that students will be better able to critically read the peer-reviewed literature.

Instructional Methods and Course Structure: This is a lecture-lab based offering (see below); lectures will be held Monday & Wednesday 1:10-2:00 pm. There will be three lab sessions held during the semester. These will be scheduled at the beginning of the semester; these sessions will be held on mutually agreed upon Friday & Saturday dates (Friday 10 am-4:30 pm & Saturday 8 am-noon).

Lecture – Lab Topics:

Monday	August 22	Lecture	Introduction and Organization/Syllabus/Course Expectations. Introduction to wine laboratory operations
Wednesday	August 24	Lecture	Quantitative analysis--measurement error; significant figures; dimensional analysis
Monday	August 29	Lecture	Approaches for quantitative analysis; evaluating an analytical method
Wednesday	August 31	Lecture <i>Carbohydrates</i>	Carbohydrates—maturity assessment, soluble solids; Brix
Monday	September 5		No classes held: Labor Day
Wednesday	September 7	Lecture <i>Carbohydrates</i>	Refractometry, hydrometry, reducing sugars
Monday	September 12	Lecture <i>Acidity</i>	Titratable acidity; pH and pKa; maturity assessment;

Wednesday	September 14	Lecture <i>Acidity</i>	Buffer capacity; K ⁺ & Na ⁺ ; malolactic fermentation
Monday	September 19	Lecture <i>Acidity</i>	Malic acid; lactic acid methods
Wednesday	September 21	Lecture <i>Acidity</i>	Volatile acidity
Monday	September 26	Lecture <i>Enzymes</i>	Enzymatic assays.
Wednesday	September 28	Lecture <i>Nitrogen</i>	Nitrogen for fermentation; ammonia; alpha amino nitrogen; NOPA
Monday	October 3	Lecture <i>Nitrogen</i>	Metals in juice and wine
Wednesday	October 5	Lecture <i>Alcohols</i>	Ethanol and other alcohols; ethyl esters; ebulliometry
Monday	October 10	Review for midterm	
Wednesday	October 12	Midterm Exam	
Monday	October 17	Lecture <i>Sulfur dioxide</i>	Introduction to SO ₂ ; uses, pH/pKa effects, temp/ethanol effects. Lab 6 reports due
Wednesday	October 19	Lecture <i>Sulfur dioxide</i>	Ripper method, aeration/oxidation; other methods
Monday	October 24	Lecture <i>Phenolics</i>	Phenolics Flavonoids, Non-Flavonoids, Anthocyanins, Tannins
Wednesday	October 26	Lecture <i>Phenolics</i>	Phenolics Flavonoids, Non-Flavonoids, Anthocyanins, Tannins, con't
Monday	October 31	Lecture <i>Wine Stability</i>	Wine Stability: Wine Hazes and Tests for Stability Potassium Bitartrate Stability; solubility product; chemistry of problem
Wednesday	November 2	Lecture <i>Wine Stability</i>	Calcium tartrate instability, metal hazes
Monday	November 7	Lecture <i>Wine Stability</i>	Protein hazes; protein isoelectric point and stability; lysozyme
Wednesday	November 9	Lecture <i>Wine Stability</i>	Bentonite; heat tests for protein stability; ethanol solubility test
Monday	November 14	Lecture <i>Wine Filtration</i>	Wine filtration; wine filtration modeling
Wednesday	November 16	Lecture <i>Wine Filtration</i>	Wine filtration modeling continued
Monday	November 21		No classes, Thanksgiving break

Wednesday	November 23		No classes; Thanksgiving break
Monday	November 28	Lecture <i>Blending/fining trials</i>	Trial blends; bench trials
Wednesday	November 30	Lecture <i>Quality control</i>	Quality control for the winery lab
Monday	December 5		Student led paper discussions
Wednesday	December 7		Student led paper discussions
Monday	December 14 1-3 pm	Final Examination	
Friday & Saturday	Tentatively September 23 & 24	Lab session 1	Lab orientation; lab safety; lab notebooks & reports; making & standardizing stock solutions; calibrations; soluble solids; residual sugars; titratable acidity; pH; volatile acidity; nitrogen for fermentation
Friday & Saturday	Tentatively October 21 & 22	Lab session 2	Malic & lactic acid; sulfur dioxide; ethanol; color and phenolics; field trip to Columbia Crest winery, Paterson, WA
Friday & Saturday	Tentatively December 2 & 3	Lab session 3	Potassium bitartrate stability; protein stability; wine filtration modeling; trial blends; instrumental analysis demonstrations

The instructors retain the right if necessary to deviate from the schedule and modify the extent of the material covered.

Text and Supplemental Materials: Reading assignments will come from journal selections and the following texts:

- Wine Analysis and Production, Zoecklein, Fugelsang, Gump, Nury Aspen publishing 1999
- Methods for Analysis of Musts and Wines. C.S. Ough and M.A. Amerine, 2nd Edition, John Wiley & Sons, New York, 1988
- Principles and Practices of Winemaking; Boulton, Singleton, Bisson, Kunkee. Aspen publishing 1998
- Techniques for Chemical Analysis & Quality Monitoring, Iland et al., 2004.
- Quantitative Chemical Analysis; D.C. Harris, 8th edition, W.H. Freeman and Company, New York, 2010

Grading: This course is developed to be a hands-on laboratory offering. There will be no make-up labs. Being present for Friday afternoon/Saturday morning laboratories must therefore be viewed as mandatory to maintain a grade of B or above.

- Student lab write-ups (40%)
- Midterm examination (20%)
- Class-lab participation (20%)
- Final Examination (20%)

Grade	% of Total Points
A	>93.0
A-	90.0 - 92.9
B+	87.0 - 89.9
B	83.0 - 86.9
B-	80.0 - 82.9
C+	77.0 - 79.9
C	73.0 - 76.9
C-	70.0 - 72.9
D+	67.0 - 69.9
D	60.0 - 66.9
F	<59.9

Attendance: This lecture meets twice a week and all students are expected to attend all scheduled lectures. The laboratory meets once a week and presence must be view as mandatory (see above). If absent for a lecture, the student is solely responsible for course content that was missed.

Lecture Conduct: No lap-top or phone emailing-texting will be tolerated during lectures

LAB SAFETY, DRESS CODE and CONDUCT

Wear closed toed shoes, safety goggles and minimize loose clothing when performing analysis on Lab days. Failure to observe lab rules will result in loss of participation.

Safety and Emergency Notification:

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. Please sign up for emergency alerts on your account at *MyWSU* to receive notification regarding campus emergencies (including campus closures). All faculty, staff, and students should register their emergency contact information for the Crisis Communication System (CCS) through [MyWSU](#). Click Update Now! under “Tri-Cities Emergency Info” to register for notification by text message, e-mail, telephone, or any combination of the three. Providing multiple contact methods will help ensure you receive notifications in a timely manner, and your information will NOT be used for any other purpose.

WSU urges students to follow the “**Alert, Assess, Act**” protocol for all types of emergencies and the “[Run, Hide, Fight](#)” response for an active shooter incident. Remain **ALERT** (through direct observation or emergency notification), **ASSESS** your specific situation, and **ACT** in the most appropriate way to assure your own safety (and the safety of others if you are able). Please view the [FBI’s Run, Hide, Fight video](#) and visit the [WSU safety portal](#). “Run, Hide, Fight” is an embedded, clickable link in the text, which will work in your electronic version of the syllabus, but if you receive a hard copy of the syllabus, “Run, Hide, Fight” can be found using Google or YouTube.

Emergency Evacuations:

Also, make sure that you are aware of evacuation procedures and assembly areas in case of a building evacuation. When the alarm sounds, everyone must leave the building and assemble in designated areas. Try to stay together. Your instructor will be the last one to exit the room, close the door(s), and direct you to the assembly areas. If any student is unable to evacuate, please notify immediately the evacuation coordinator (who should be wearing a green vest) so that the issue can be addressed.

At this time, the assembly areas are:

- East/West and BSEL: the blue emergency pole located directly south of the BSEL sidewalk, parking row 6.
- CIC: blue emergency pole in row 1, directly down the diagonal sidewalk from the main entrance.
- Wine Science: the WSU sign at the corner of University & George Washington Way
- ICB: south edge of parking lot
- Nursing: southeast corner of parking lot, near Chapala Express

Each classroom has an evacuation map next to the door. Be sure you are familiar with it.

Academic Integrity:

Academic integrity is the cornerstone of the university. You assume full responsibility for the content and integrity of the academic work you submit. You may collaborate with classmates on assignments, with the instructor's permission. However the guiding

principle of academic integrity shall be that your submitted work, examinations, reports, and projects must be your own work. Any student who violates the University's standard of conduct relating to academic integrity will be referred to the Office of Student Conduct and may fail the assignment or the course. You can learn more about Academic Integrity on your campus using the URL listed in the Academic Regulations section or to <http://academicintegrity.wsu.edu/resources-for-faculty/>. Please use these resources to ensure that you don't inadvertently violate WSU's standard of conduct.

Disability Support Services:

According to Section 504 of the *Americans with Disabilities Act (ADA) of 1990*, “institutions of higher education are obligated to provide services to students with disabilities.” At WSU, reasonable accommodations are available on a case-by-case basis for students with a documented disability. The student should notify WSU Tri-Cities’ Office of Disability Support Services (<http://www.tricity.wsu.edu/disability/>) during the first week of classes if accommodations are needed. The Office will approve the appropriate accommodations requested by the student. Instructors will receive a Memorandum of Introduction, along with a Signature Sheet. The instructor must keep the Memorandum and sign the Signature Sheet, which the student returns to the Office. The student does not have to disclose his/her disability — only the needed accommodations. The instructor is responsible for providing the approved accommodations. The Office will provide assistance to the instructor.