

CHE 508 Statistics and Instrumentation (Spring 2018)

Meeting time: MWF 10:00 - 10:50 AM, Fronczak 422

Instructor: **Professor Troy D. Wood**

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Course web site is at <http://ublearns.buffalo.edu>

Text: There is no required text for this course; course notes will be provided to students on the ublearns course website. However, we will be using information from *Principles of Instrumental Analysis, 6e* (ISBN: 978-0495012016) by D. A. Skoog, F. J. Holler, and S. R. Crouch, 2006: Brooks-Cole or *Fundamentals of Analytical Chemistry, 8th Edition* by Skoog, West, Holler and Crouch, *Analytical Chemistry (online)* by Troy Wood, 2017 (ISBN 978-1-77330-103-7).

Overview

Broadly, this course will focus on analytical separations and statistical methods as they apply to analytical separations techniques.

Analytical Separations: This topic will cover fundamentals of separation sciences, emphasizing chromatographic theory and instrumentation. General concepts in chemical separations will be reviewed, followed by the presentation of commonly used techniques (e.g. GC, HPLC). The course will introduce the students to recent advancements in analytical separations. Specifically, we will discuss capillary separation techniques (i.e., capillary electrophoresis, open tubular liquid chromatography and electrochromatography) employed in the analysis of minute sample quantities. Reference material will be taken from the current literature.

There will be four quizzes during the semester. The quizzes will be *unannounced* to encourage regular review of the material. There will also be two examinations, one mid-term and one comprehensive final which will stress material from the second half of the course. ***These examinations will be take-home in nature.*** You are expected to provide your own written responses to the questions on these examinations, although you are free to consult any written or electronic resources to your responses (while providing the appropriate citations to pertinent literature in drafting responses).

The course material will rely heavily on the lecture and the material in the textbook. Many of you will have one or both of the recommended textbooks from your undergraduate courses. Earlier editions are acceptable. A printed version of the text (particularly for analytical students) is recommended as eBook texts have a limited license.

Learning Outcomes

Upon completion of this course:

- 1) Students will be able to apply commonly-used statistical principles in chemical analysis.
- 2) Students will know the nature of the physical principles exploited for modern separations analysis.
- 3) Students will be able to distinguish between different types of chromatographic separations and electrophoretic separations.
- 4) Students will be able to discuss the merits and drawbacks of instrumental components and techniques commonly employed using various chromatographic and electrophoretic approaches.
- 5) Students will be able to critically evaluate the best separations techniques to use for given applications and to justify their use.
- 6) Students will be able to apply their knowledge of separations techniques to research problems.

Assessment Tools

The course uses both quizzes and examinations to assess how well these learning outcomes have been mastered by the student. Skills are built cumulatively.

- 1) Students will be able to calculate statistical measures used in chemical analysis in quiz 1 and on the midterm examination.
- 2) Student comprehension of technical terms used in separations science will be addressed in both examinations and quizzes 2-5.
- 3) Fundamental understanding of the principles involved in evaluating column efficiency and performance will be addressed in both examinations and quizzes 2-5.
- 4) The distinctions between gas chromatography and liquid chromatography, including the types of detectors used, will be addressed in quizzes 2 and 3 and both examinations.
- 5) Distinction between types of gas chromatography and liquid chromatography will be addressed on both examinations.
- 6) Details of supercritical fluid chromatography, electrophoresis, and field flow fractionation will be addressed in quiz four and the final examination.
- 7) Critical evaluation of the best separations techniques to utilize for given applications will be assessed as problems in chemical analysis on the final examination, and students will explain which technique(s) were chosen and why for the given chemical problem detailed.
- 8) Readiness for application of the knowledge of separations techniques to the laboratory setting will be assessed on every quiz and examination in the course using both essay and computational problem solving questions.

Grading:

Grades are based upon the number of points scored on exams and quizzes. In determining final grades I look at the overall point distribution. The grade is distributed as follows and is based on two take-home examinations and five (unannounced) in-class quizzes:

Mid-term exam (Due, Friday March 16, 5 PM)	40%
Final exam (Due: Friday May 18, 5 PM)	40%
Quizzes (5, lowest quiz dropped in calculation of final grade)	20%

Both exams are take-home, and will be given to the student at least two weeks prior to the due date. Exams

can be submitted on paper or electronically. Directions on length of specific essay questions will be provided on the examinations themselves.

Quizzes in CHE 508 will be closed-note and may require calculations, so bringing a calculator with you regularly is strongly encouraged. If for some reason you know in advance you are going to be absent during one of the scheduled quiz dates (e.g. because of a conference or other appointment) please let me know in person (and with an email message) so we can arrange for an alternate quiz.

Undergraduates enrolled in the course will follow a slightly different grading scale than those of the graduate students in the course—in other words, your grade will be based on your own performance within your peer group. However, in the past I have noted not much difference between the performance of undergraduate and graduate enrollees, so do not anticipate significant differences in the scales used for determination of final grades.

Academic misconduct will not be tolerated, and will result in a zero for the assignment on a first offense. More serious consequences will result from subsequent infractions. **This means that while the exams are take-home in nature, efforts on them are individual and the written responses are expected to be unique; citations to material used in composing an essay are EXPECTED. This is a small class--I will catch you if you do this, so don't.**

Attendance Policy:

Class attendance and participation are expected in this course. Quizzes missed for non-attendance that are not documented with a valid excuse (documented illness, family emergency, car accident, etc.) cannot be made up.

Students Requiring Accommodations:

The Chemistry Department works closely with the Office of Accessibility Resources to make it possible for anyone wishing to take a Chemistry course to do so. Special arrangements can be made for handicapped students who cannot take examinations or quizzes in the normal manner and for those who cannot perform laboratory experiments unaided with the normal equipment. All such arrangements must be made well in advance of the event by contacting Mr. Randall E. Borst, Director of Accessibility Resources, 60 Capen Hall and Dr. Wood for examinations quizzes.
