CHEMISTRY 2270-1 and 2270-2 (Lecture/Lab Combined Course)
QUANTITATIVE CHEMICAL ANALYSIS – ONLINE
SPRING 2020

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Synchronous class meetings: 1100 AM – 1150 AM MWF (lecture course); Section 1 lab meets Monday 200 -450 PM; Section 2 lab meets Tuesday 200 -450 PM (Denver time). ***Synchronous lab sessions will commence in Week 2.***

Contact Hours: In lieu of in-person office hours, I will be available as follows for virtual office hours: Wednesday 100 – 300 PM; Friday 900 – 1100 AM Denver time. During these hours, you can contact me individually by telephone, Skype, FaceTime video, or other electronic means to be specified. Appointments can be made for one-on-one audio or video contact at other times; please contact me by email if you wish to arrange a consultation at an alternative time.

Textbook: Daniel C. Harris and Charles A. Lucy, Quantitative Chemical Analysis, Tenth Edition. ISBN-10: 1-319-16430-7; ISBN-13: 978-1-319-16430-0. ***Editions 7 through 10 should all be useable, and the course is designed to accommodate any of these versions.*** You can likely find inexpensive PDF versions of Editions 7-9.

Materials Provided by Instructor: Course materials will be distributed on Canvas. Please expect lecture materials to be posted on Monday AM in weekly segments applicable to the upcoming week; experiments for the laboratory will also be posted in a one-at-a-time manner.

Course Description: CHEM 2270 provides a sound understanding, based upon chemical transformations, and physical properties – in the science and art of chemical analysis. Emphasis is placed upon using chemical transformations, spectroscopy and electrochemistry to measure and explain ***the components of aqueous solutions***, although chemical analysis entails characterization of ***all forms of matter***. The course demonstrates how these principles are applied in contemporary chemical analyses conducted as part of scientific/technical investigations in wide variety of disciplines.

Course Prerequisites: This course builds upon and follows General Chemistry I, General Chemistry II, and Chemistry of the Elements. CHEM 2270 assumes that you have mastered all three of these courses with a "B or better" level of knowledge. CHEM 2270 requires significant

proficiency with algebraic operations, although minimal calculus is involved/assumed. You will need to be able to do algebraic manipulations relatively well. You may find it useful to attempt a General Chemistry II pre-test, which is posted on Canvas.

What to expect in the course delivery in an online format: please refer to my email of March 27, 2020 regarding the anticipated format and procedures of the class. We may need to make adjustments or changes, either to content or course procedures, as circumstances warrant. I pledge to be flexible and adaptable during the current world situation.

Homework: Homework will be distributed electronically as packets throughout the semester. These problems will not be collected/graded; solutions will be provided and posted on Canvas. Selected questions will be discussed in synchronous sessions; you are welcome/encouraged to discuss these questions, either in the synchronous sessions, virtual office hours, or in individual follow-up.

Exams: ***There will be two mid-term exams during the Quarter.*** Each will focus on material covered to date commencing with the previous exam. The anticipated dates for these exams are:

Exam 1, Week 4: April 22 posted; due on April 24 (48 hour window)
Exam 2, Week 8: May 20 posted; due on May 22 (48 hour window)

The instructor reserves the right to adjust the posting and due dates of exams in order to make allowances for the progress of the class.

Bonuses and extra credit: Possible, but not guaranteed.

Final Exam: The final exam will be posted on Monday, June 8; you will have a 48-hour window to complete the exam, which will be due on Wednesday June 10.

How to submit your exams: All exams should be submitted electronically in the form of a single PDF file named as follows: First Name_Last Name_Exam_X.PDF. Exams may be sent by email to Michael.Ketterer@du.edu, and we will attempt to install a mechanism for submitting exams electronically *via* Canvas. We will follow similar procedures for laboratory reports. Your graded materials will be returned to you via email. It is your responsibility to review your graded work.

Academic Honesty: All work in CHEM 2270 is to be prepared/submitted on an individual basis. You are expected to abide by the Pioneer Pledge and the Honor Code of the University of Denver.

Pioneer Pledge: http://www.du.edu/studentlife/ccs/pledge.html
Honor Code Statement: http://www.du.edu/studentlife/ccs/honor_code_2011-2012.pdf

Grades: you will receive a single grade for this course reflecting both your lecture and lab components. The distribution of weights is as follows:

Two mid-term exams (15% each) = 30 % weight
Final exam = 30 % weight
Laboratory reports = 40 % weight

The anticipated grading scale is as follows:

	A		B			C			D		
Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
Percentage minimum	95	90	86	82	77	74	70	65	61	57	55

The final grading scale ***will not*** be made higher than stated above; the instructor reserves the right to produce more lenient final curves and/or provide additional extra credit incentives during the Quarter. ***No "curves" for individual exams will be designated.*** As the Quarter progresses, please use the guaranteed scale to predict your outcome, but do not rely upon anything more generous.

Inquiries about grades: Students are entitled to know how their performance compares to the guaranteed grading scale. Please minimize inquiries about "what is my present grade" or "what do I need to do on the final to pull off an A", etc. These are things you should answer for yourself, using your test score information, as the calculations are quite facile.

CHEM 2270 Lecture Schedule (chapter numbers correspond to 10th Ed.)

The following approximate schedule pertains to this Quarter's lecture component. Note that different specific chapters will be covered with varying emphases and levels of detail:

Week 1	Chapter 0 The Analytical Process Chapter 1 Chemical Measurements Chapter 2 Tools of the Trade
Week 2	Chapter 3 Experimental Error Chapter 4 Statistics
Week 3	Chapter 5 Quality Assurance and Calibration Methods; Detection Limits
Week 4	Chapter 6 Chemical Equilibrium Chapter 8 Activity and the Systematic Treatment of Equilibrium **Mid-term Exam 1**
Week 5	Chapter 9 Monoprotic Acid-Base Equilibria Chapter 10 Polyprotic Acid-Base Equilibria
Week 6	Chapter 7 Let the Titrations Begin Chapter 11 Acid-Base Titrations Chapter 12 EDTA Titrations
Week 7	Chapter 14 Fundamentals of Electrochemistry Chapter 15 Electrodes and Potentiometry
Week 8	Chapter 16 Redox Titrations Chapter 17 Electroanalytical Techniques **Mid-term Exam 2**
Week 9	Chapter 18 Fundamentals of Spectrophotometry Chapter 19 Applications of Spectrophotometry
Week 10	Modern instrumental techniques: overview of spectroscopy, mass spectrometry, and chromatography; selected topics of Chapters 21 – 26 will be presented
Week 11	**Final Exam (**will cover both lecture and laboratory components)

Note that there will be no synchronous lecture session on Monday May 25 (Memorial Day)

CHEM 2270 Laboratory Schedule

Week 1	Datasets for Weeks 2 to 4 distributed
Weeks 2, 3	**Experiment A:** Statistical analysis of datasets: masses of US pennies; metal concentrations in contaminated soils from El Paso/Ciudad Juarez
Week 4	**Experiment B:** Calibration practices and limits of detection: El Paso/Ciudad Juarez dataset; reports due for Experiment A
Weeks 5, 6:	**Experiment C:** Potentiometric titration of a polyprotic acid, H_3PO_4; precipitation titration of chloride with Ag^+(aq); titration of Mg^{2+} and Ca^{2+} in natural waters with EDTA; reports due for Experiment B
Week 7:	**Experiment D:** determination of fluoride with a solid-state ion-selective electrode; electrogravimetric analysis of Cu in an ore; reports due for Experiment C
Weeks 8, 9	**Experiment E:** Spectrophotometric determination of Co^{2+} and Cr^{3+} Fluorimetry: determination of quinine in tonic water; reports due for Experiment D
Week 10	**Experiment F:** Inductively coupled plasma mass spectrometry: Pb, As in drinking water; reports due for Experiment E
Week 11	**Final Exam** (will cover both lecture and laboratory components)

Note that there will be no synchronous lecture sessions on Monday, May 25 and Tuesday, May 26, owing to the Memorial Day holiday. You should use the available time to complete your work on the spectrophotometry and fluorimetry datasets.

Experiment F will not require a regular report; instead, please expect to see some questions on the Final Exam reflecting your work on Experiment F.

Due dates for laboratory reports: the reports for Experiments A through E will be due at the beginning of your next week's regularly scheduled synchronous lab session; for example, the lab reports for Experiment A will be due in Week 4; please submit reports before 200 PM on Monday, April 20 and Tuesday, April 21, respectively, for the two individual lab sections.