

## **CHEM 251 - ANALYTICAL CHEMISTRY - Spring 2018**

**Lectures: Mon., Wed. & Fri. 1:00 - 1:50 pm WC-201**

**Labs: CLS 424 Tue. or Thur. 8:00 - 12:40 or 1:00 - 5:40**

**Instructor:** Prof. Christopher R. Harrison

Office: GMCS-213E

Office hours: Mon. & Wed. 9:00 -10:00 am & by appointment

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**Textbook:** “Analytical Chemistry 2.1” David Harvey (**FREE**)

Downloadable at: [\*\*http://bit.ly/2kQioMo\*\*](http://bit.ly/2kQioMo)

**Lab Manual:** Available in the bookstore - updated for 2018

**Lectures:** As this is a flipped classroom the lectures have been prerecorded and are available through Blackboard. The class time will be used to work on problems and master the topics covered in the lectures.

### **Course Materials:**

All course materials (aside from the textbook and lab manual) will be made available through Blackboard.

### **Homework:**

Short homework assignments will be distributed periodically throughout the semester. The assignments will be distributed and collected electronically, details can be found in Blackboard.

### **Lab Results:**

All lab results will be submitted via your lab Blackboard sections. Lab results will need to be submitted periodically, as indicated in the lab manual.

### **Lab Notebook:**

The week following each lab result submission deadline the lab notebooks will be collected by your TA and graded for proper data recording, as indicated in the lab manual.

**Exams:**

All mid-semester exams (3) will take place in the regular class time in the designated classroom. The exam questions will include calculations and theory, from both the lectures and labs. The final exam is scheduled by the university and will be two hours long.

**Expected Student Learning Outcomes:**

- Students will evaluate and interpret the error and uncertainty in measurements.
- Students will apply statistical tools, such as Student T's, F, and Grubbs tests to the comparison of data from chemical analyses in order to identify different and/or equivalent results.
- Students will be introduced to a range of sampling techniques/methods and their advantages and limitations.
- Students will apply their knowledge of acid/base equilibria for the preparation and evaluation of buffers to meet specific requirements.
- Students will be chemical equilibria using both chemical concentrations and chemical activities, thus identifying the limitations in the use of chemical concentrations in calculations.
- Students will explore a range of titrimetric analysis techniques and use their knowledge of the related chemical equilibria to predict the chemical changes through the process of the titrations.
- Students will be introduced to the techniques related to gravimetric chemical analysis.
- Students will apply their knowledge of redox chemistry to the calculation and evaluation of electrochemical analytical methods.
- Students will quantify chemical concentrations based on spectroscopic data, relating chemical interactions with light to the quantity of chemical present in solution.
- Students will be introduced to the fundamental equilibria which govern chromatographic chemical separations.

**Grading Plan:**

As with any course, the grade that you receive is based upon your demonstrated knowledge of the course material. With this in mind, each graded element of this course will be used to evaluate your mastery of the material. You will enter the course with a total of **ZERO** points, doing assignments, labs and exams will earn you points. The total number of points that you earn will determine your final course grade.

In the tables below you will find the point values for each course component. You will notice that for the homework, only three of the five assignments are counted in the points total. If more than three assignments are completed only the points from the three highest scoring assignments will be counted; though if your final point total falls near a higher grade cutoff, completion of all assignments might result in a bump upwards. All assignments carry the same total point value, though they may vary in difficulty. With the labs, only the best eight results will be counted, the lowest scoring lab, if all nine are submitted will not be counted.

### Baseline Points Values

Component	Quantity	Each	Total	% of Total
Lab Notebook	3	5, 5, 10	20	5%
Homework	10	5	50	13%
Lab Results	Best 7 of 8	10	70	18%
Analytical Scientists*	2	20	40	11%
Mid-semester Exams	3	50	150	39%
Final Exam (cumulative)	1	50	50	13%
<b>Total</b>			<b>380</b>	

\* Specific details for the Analytical scientist assignment are still being finalized, but this will principally be a research based project. The first part will consist of you developing a biography of an assigned analytical chemist. These chemists will be world experts in their field, learning what they do will give you better insight into what applied analytical chemistry entails. The second part is still being finalized, but will likely require you to determine how your assigned analytical chemist could contribute to solving a challenging analytical problem; this may be a group based assignment.

## Lecture schedule

Below is the preliminary schedule for the course. The schedule may be subject to changes depending on the pace at which the course progresses. The dates for the exams will remain fixed.

Week	Dates	Topics	Chap.	Videos	Problem Sets
1	1/16-1/19	Analytical chemistry overview, calculations	1	1-3	1
2	1/22 - 1/26	Measuring Tools & Measurements	2A-E & 4A	4-7	2
3	1/29 - 2/2	Distributions & Statistical Analysis	4B-F	8-15	3-5
4	2/5 - 2/9	Sampling & Equilibrium	7A-C & 6A-F	16-19	6,7
5	2/12 - 2/16	Acid-Base Equilibrium	6G	20-22	8
-	Fri. 2/16	<b>Exam 1 - Videos 1-19</b>			
6	2/19 - 2/23	Buffers	6H	23-25	9
7	2/26 - 3/2	Activity coefficients & Equilibria	6I	26-27	10
8	3/5 - 3/9	Titrimetric Analyses - acid-base	9A-B	28-31	11,12
9	3/12 - 3/16	Titrimetric Analyses - complexation & redox	9C-D	32-37	13-15
10	3/19 - 3/23	Titrimetric Analyses - precipitations	9E	38-39	16
-	Fri. 3/23	<b>Exam 2 - Videos 20-37</b>			
-	3/26 - 3/30	<b>Spring Break</b>			
11	4/2 - 4/6	Standardization & Calibration	5A,B,C,E	40-43	17
12	4/9 - 4/13	Electrochemical Analyses	11A-B	44-47	18
13	4/16 - 4/20	Spectroscopic Analyses	10A,B,D-G	48-52	19
-	Fri. 4/20	<b>Exam 3 - Videos 38-52</b>			
14	4/23 - 4/27	Chromatography & Electrophoresis	12	53-56	N/A
15	4/30 - 5/2	Review			
-	Fri. 5/4	<b>Final Exam 1:00-3:00 pm</b>	<b>Cumulative</b>		

### Lab Schedule:

- Labs begin on January 27<sup>th</sup> and will proceed until April 30<sup>th</sup>.
- The first two weeks of the lab are designated for lab check-in and equipment calibration - come to the labs prepared.
- The lab grades are based on your quantitative analysis results for each lab, those results are submitted through Blackboard, with the grade determined by the accuracy of the analysis.
- There are four designated lab submission deadlines (see lab manual) when a specific number of analyses must be submitted for grading.
- Labs can be graded upon request outside of the scheduled submission deadlines.
- Labs will only be graded ONCE. The grade received is FINAL.
- There will be a set schedule for each student to do the analyses.

### Grading:

- The lab grades are determined by the accuracy of your analysis and are ranked out of 10 points. To obtain 10 points for a lab you must have a very accurate analysis. The lowest grade for any submitted lab will be 2 points.
- Your final letter grade will be determined based upon the total number of points you have earned throughout the course. A tentative grade distribution (in percentages) is tabulated to the right. Note particularly high or low class averages may shift the grade distribution.
- Note: The grading scale (right) is only an example. You are NOT guaranteed the corresponding letter grade for achieving a given percentage grade. Your final letter grade will be influenced by the overall class grade distribution to reflect your rank in comparison with your classmates.
- The Grade Center in Blackboard is used to display all your individual grades, it is not used to calculate your final grade, due to the best X of Y nature of some of the grading components. Please use the Grade Center to verify that the correct grade has been entered for your assignments and midterms.

Letter	Cutoff
A	85%
A-	80%
B+	76%
B	73%
B-	70%
C+	66%
C	63%
C-	60%
D+	56%
D	53%
D-	50%
F	< 50%

**On-Line Material:**

- Please ensure that Blackboard has your correct/active email address as the Blackboard email feature will be frequently used to relay pertinent course information. It is your responsibility to ensure that you are receiving these communications.
- All course materials will be distributed and accessed through Blackboard.
- Some course components will be conducted through Google Drive, such as Google Forms for the submission of lab results. Links to these items will be provided through Blackboard.

**Absence & Deadline Policies:**

- All deadlines are firm and extensions will not be provided on an individual basis.
- Technology failures (e.g. webpages not loading, dog ate my computer, internet being down...) are likely to occur, do not leave the submission of homework or labs to the last minute. No extensions will be provided for such occurrences.
- Each student will be allowed one unexcused absence from a lab. For this absence the student will be allowed to make-up the missed lab period in one of the other lab sections. The student is not guaranteed to have access to any of the labs that require advanced sign-up when making-up a lab in a different lab section.
- Subsequent absences from lab may be allowed to be made-up provided that there was appropriate justification, as determined by the course instructor, for the missed lab.
- Unexcused absences for an exam will be treated as a zero. If an excused absence is allowed (e.g. medical reason, conference schedule conflict...) the points value for the exam will be redistributed over the other exams.

**Test Accommodations:**

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Disability Services. Your cooperation is appreciated.

Students who have made arrangements with SDS for test accommodations and require a signature from an instructor must make arrangements to meet the instructor outside of the class time to obtain a signature. Absolutely no forms will be signed immediately prior to, during, or after a lecture.