

Chemistry 241: Analytical Methods in Lund, Sweden

Summer Session – 2018 (Section 1)

MTWRF: 9:00 am - 10:15 am

Professor: Domenic J. Tiani, Ph.D.

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*There will be a 15 min break between the Chemistry 241 and Chemistry 190 classes.

OFFICE HOURS & CLASS HELP: I will be staying in the same hotel as all of you and once I know my room number, I will make sure all of you have this information. I will hold office hours in the Hotel Lobby each day. I will be available regularly throughout each day also to provide help, to talk, and to answer questions. We will also hold periodic help sessions in the afternoons at the External Relations Building. These help sessions will be announced during class and communicated to everyone.

CLASS LOCATION: Stora Algatan 4 (Lund, Sweden) External Relations (Externa Relationer) Building: Ground Floor, Lecture Hall 128.

LEARNING OBJECTIVES:

By the end of this course students will:

- Gain a broad understanding and introduce students to the major fundamentals behind modern analytical methods and techniques in the areas of analytical spectroscopy, electrochemistry/sensors, and separation science/ chromatography; and to learn how these methods are utilized to make chemical measurements and solve real world analysis problems across many disciplines.
- Gain a better understanding of chemical equilibrium and how to solve more advanced equilibrium problems.
- Learn how to solve advanced acid-base equilibrium problems and learn how these concepts apply to biological and biochemical systems.

CLASS WEBSITE: The website for this class is located at sakai.unc.edu. You will need to check this site daily for any new class announcements. I will also use this site to post a variety of other course information and material: course syllabus, reading assignments, problem assignments, articles, exam keys, useful websites, and grades.

PREREQUISITES: A C- or better in Chemistry 102 or 102H.

REQUIRED TEXTBOOKS

- **Required:** *Custom Edition - Quantitative Chemical Analysis*, 9th ed., Daniel C. Harris. The custom edition contains only those chapters that we cover in Chemistry 241. I will bring a copy of the solutions manual that I will make available to students to look at.

- Given how that any student going abroad has to consider how much they need to pack and bring with them, **you may want to consider an E-Text Option or Rental of E-Text Option**. It is something to be aware of and consider: Go to VitalSource website for information:

<https://www.vitalsource.com/products/quantitative-chemical-analysis-harris-daniel-c-v9781319048037>

EQUIPMENT

- Two scientific calculators. Most students have a good scientific calculator (TI-XX). I strongly encourage you to purchase a less expensive basic scientific calculator as a backup calculator.
- Bring a back-up calculator and extra batteries to every exam. You will not be allowed to share calculators during exams and calculators will not be provided.
- You are not permitted to use your cellular phone in place of a calculator.

CLASS ATTENDANCE

- Regular attendance is important to your ability to succeed in this class. The pace in the summer is much faster and more demanding, since we meet every day.
- A requirement of the Study Abroad Program is that you attend all scheduled classes and class functions, unless you are sick. If you are sick and cannot attend a class, text me via *WhatsApp* to let me know.
- Please be punctual to all classes and exams.

END OF CHAPTER PROBLEM ASSIGNMENTS

- Problems from the end of the chapter will be assigned for you to work after each lecture. These problem assignments are not collected or graded.
 - Work the assigned problems as the material is covered in class.
 - Do not put off the reading and problem assignments.
- Problem and reading assignments from your textbook will be posted on Sakai under *Assignments*.
- Problem assignments are meant to assess your understanding of the lecture material; they will not be collected or graded.
- Try to work the problems with as little aid from your solution manual as possible. If you consistently find yourself turning to the solution manual to work the problems, go back and re-read the text and your notes, and then try to work the problem again.
- Try to avoid working problems to simply come up with an answer. Focus on understanding the principles underlying each problem.
- Work the example problems and the “Test Yourself” problems within the chapter.

COURSE COPYRIGHT INFORMATION

- All materials used in this course including notes, tests and assignments are covered by copyrights, which forbid you from sharing class materials with any group not

affiliated with this class. This includes sharing in-class activities or group work questions.

- University Copyright Policy (see following link) indicates: "***Student works that constitute notes of classroom and laboratory lectures and exercises shall not be used for commercial purposes by the student generating such notes.***" What this means is that you are in violation of the law (and the honor code) if you post any course materials for use by others.

<http://www.unc.edu/campus/policies/copyright%20policy%2000008319.pdf>

- Sharing your notes directly with other individuals enrolled in the class is fine.

EXAMS & BREAKDOWN OF GRADED WORK

- Three semester exams will be given on the following dates.

Exam 1: Tuesday, 5/22

Exam 2: Thursday, 5/31

Exam 3: Monday, 6/11

- Cellular phones are not permitted to be out at any time during exams, violations of this policy will be treated as an honor code violation.
- The **Final Exam** is cumulative and is scheduled for **Friday, June 15 from 9:00 a.m. – 12:00 p.m.**
- Your letter grade for the course will be based on your overall weighted percent score from the following list of weighted graded work this semester.

3 Semester Exams (100 points each)	300
Final Exam	200
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Total Points	500

SEMESTER EXAM REPLACEMENT POLICY

- I will replace TWO of your semester exam scores if you score a higher relative grade on that portion of the final exam that corresponds to that particular semester exam.
- The final exam will consist of four 50-point sections.

Acid-Base Equilibria
Chromatography & Separations
Spectroscopy
Sensors and Ion Selective Electrodes

- To determine which semester exam score is replaced I will first double the scores from the acid-base, chromatography, and spectroscopy sections of your final exam and then compare these scores (now out of 100) to your regular semester exam scores. I will replace those semester exam scores that will give you the largest increase in your overall class score.

Example:

Final Exam:	Section 1: Sensors & Ion-Selective Electrodes	40/50
	Section 2: Spectroscopy	35/50 → 70/100
	Section 3: Acid-Base Equilibria	45/50 → 90/100
	Section 4: Chromatography	40/50 → 80/100
	Final Exam Score =	160/200

Exam 1	60/100	Replace with 90.
Exam 2	75/100	
Exam 3	94/100	

In the above example the student scored better on the acid-base and chromatography sections of the final, relative to their semester Exam 1 and 2 performances. The Exam 1 score (60) will be replaced with a 90 because this gives the largest increase in the overall percent score.

- There are no make-up exams. If you miss a semester exam for any reason, your section score from the final exam will be used for the missing exam score.

GRADES

The letter grades for the course will be determined based on the percentage of the total points you earned and will be assigned as follows:

Final Average	Letter Grade
93 - 100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
75 - 79	C+
66 - 74	C
60 - 64	C-
50 - 59	D
< 50	F

HONOR CODE: Policy adopted by the faculty of the Department of Chemistry on Sept. 9, 1977:

“Since all graded work (including homework to be collected, quizzes, papers, mid-term examinations, final examinations, research proposals, laboratory results and reports, etc.) may be used in the determination of academic progress, no collaboration on this work is permitted unless the instructor explicitly indicates that some specific degree of collaboration is allowed. This statement is not intended to discourage students from studying together or working together on assignments which are not to be collected.”

CLASS SCHEDULE:

- Below is a tentative class schedule for the semester and is subject to change. The specific sections and topics covered each class period will be posted on Sakai under *Pre-Lecture Assignments*.
- If a topic or topics are changed in the below schedule, this will be announced ahead of time in class.
- In some sections we may not cover all the topics in that section, which is not evident from the below schedule. As stated above, the specific reading assignments for each chapter and section will be posted on Sakai under *Pre-Lecture Assignments*.

Day	Date	Lecture Topics
Monday	5/14	Introduction to Analytical Chemistry Chapter 9: Case of a Dilute Strong Acid or Strong Base (9-1) Leveling Effect (11-1)
Tuesday	5/15	Finish Case of Dilute Strong Acid or Dilute Strong Base Mono- & Polyprotic Weak Acid & Weak Base Equilibria (Sections 9-2, 9-3, & 9-4 {Ch. 9} & Sections 10-1 & 10-3 {Ch. 10})
Wednesday	5/16	Finish Weak Acid & Weak Base Equilibria Buffer Solutions, Buffer Problems, & Fundamentals of Buffer Solutions – (Sections 9-5 & 10-2)
Thursday	5/17	Buffer Solutions, Buffer Problems, & Fundamentals of Buffer Solutions Start Fractional Composition & Predominate Species in Acid/Base Solutions – (Sections 10-4 & 10-5)
Friday	5/18	Isoelectric pH and Isoelectric Focusing – Section 10-6 Start Acid-Base Titrations – Sections 11-2, 11-3, & 11-4
Monday	5/21	Acid-Base Titrations – Sections 11-2, 11-3, 11-4, & 11-6 Start Introduction to Chromatography & Analytical Separations Unit: Solvent- Solvent Extraction - Section 23-1 (Ch. 23)
Tuesday	5/22	Exam 1
Wednesday	5/23	Finish Solvent-Solvent Extraction Introduction to Chromatography and Fundamentals of Chromatography – Sections 23-2, 23-3, & 23-4
Thursday	5/24	Fundamentals of Chromatography & Separation Efficiency – Sections 23-3, 23-4, & 23-5
Friday	5/25	Fundamentals of Chromatography & Separation Efficiency – Sections 23-2 through 23-4
Monday	5/28	Finish Chapter 23 and Start GC & HPLC – Sections 24-1, 24-2, 24-3, & 25-1

Tuesday	5/29	GC & HPLC Instrumentation Demo Day - Lund University, Department of Chemistry
Wednesday	5/30	Finish GC & HPLC (Chapters 24 and 25) Internal Standards – Section 5-4 (Chapter 5) Possibly Start Size Exclusion Chromatography (SEC) – Section 26-3
Thursday	5/31	<i>Exam 2</i>
Friday	6/1	Size Exclusion Chromatography – Section 26-3 (Ch. 26) Start Capillary Electrophoresis (CE) – Sections 26-6 & 26-7
Monday	6/4	Finish Capillary Electrophoresis (CE) & Applications of CE - Sections 26-6 & 26-7) Molecular Spectroscopy – Sections 18-1 through 18-3 in Chapter 18
Tuesday	6/5	Introduction to Molecular Spectroscopy & Fundamentals of Molecular Spectroscopy – Sections 18-1 through 18-3 (Ch. 18) Application of Beer's Law in Chemical Analysis – Section 18-4
Wednesday	6/6	<i>No Classes – National Day of Sweden (A National Holiday)</i>
Thursday	6/7	Standard Addition Method – Section 5-3 (Ch. 5) Dual Beam vs. Single Beam Spectrophotometers – Section 20-1 Light Sources: Tungsten & Deuterium Lamps and Lasers – Section 20-1
Friday	6/8	Finish Light Sources - Section 20-1 Monochromators – Section 20-2 Detectors for Spectrophotometry – Section 20-3 Jablonski Diagram – Section 18-6
Monday	6/11	<i>Exam 3</i>
Tuesday	6/12	Jablonski Diagram (Deactivation Processes) & Luminescence – Section 18-6 & 18-7 (Ch. 18) Start Sensors & Ion-Selective Electrodes – Chapter 14
Wednesday	6/13	Ion-Selective Electrodes and Their Use in Chemical Analysis – Sections 14-5 to 14-7
Thursday	6/14	Ion-Selective Electrodes and Their Use in Chemical Analysis – Sections 14-5 to 14-7
Friday	6/15	<i>Final Exam: 9:00 AM – 12:00 Noon</i>
Saturday	6/16	<i>Schedule Your Departure for Saturday, 6/16</i>