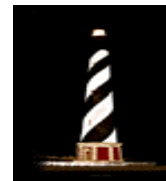




Chemistry 221

Instrumental Analysis

Spring 2020



LECTURE:	<ul style="list-style-type: none">• MWF 8:30-9:20 a.m.• 305 Votey Hall
INSTRUCTOR:	<ul style="list-style-type: none">• Professor Joel Goldberg (he/him)• E356 Innovation Hall• (802) 656-4394• Joel.Goldberg@uvm.edu
DESCRIPTION:	<p>This 3-credit course presents a survey of instrumental methods of chemical analysis. We will focus on understanding the fundamental principles underlying instrumental methods and their realization in modern instrumentation for chemical analysis. We will focus on the following broad methodological areas:</p> <ul style="list-style-type: none">• Electrochemistry,• Chromatography,• Optical Spectroscopy, and• Mass Spectrometry. <p>This is <i>not</i> a "how-to" course; you will not learn how to operate analytical instruments nor will we cover specific analytical "recipes;" these change (sometimes quite quickly) with time as the discipline grows, so our focus on principles and concepts of implementation should provide greater insight both into how current instruments work as well as the basis for your understanding how they will work a decade from now.</p> <p>Lastly, we will pay attention to the chemical systems to which these methods are applicable and how best to obtain the chemical information desired using the most appropriate instrumental methods.</p>
LEARNING OBJECTIVES:	<p>You should develop an understanding of the analytical capabilities of a number of instrumental methods and be able to suggest suitable instrumental methods for particular analytical problems. In order to choose the best instrumental method for addressing an analytical problem, we will consider:</p> <ul style="list-style-type: none">• the property or quantity of the chemical system to be measured,• the physical and chemical principles upon which the measurement is based,• generation of a signal by a suitable detector (transducer) and the processing of the signal to convert it to a form appropriate for a readout device, and• the strengths and limitations of each particular instrumental method or approach. <p>In order to make these kinds of assessments, you will need to understand:</p> <ul style="list-style-type: none">• the chemical and/or physical principles exploited during the measurement• how the instrument actually makes the measurement, and• some of the techniques used to improve analytical figures of merit (such as accuracy, precision, and sensitivity).
OFFICE HOURS:	<p>I am available this semester at the following days/times :</p> <ul style="list-style-type: none">• tbd <p>Have a question and cannot make it to one of my office hours? Email me - be sure to include "CHEM 221" in the subject line to ensure that I can give it prompt attention; if this is something we cannot address electromagically, suggest some days and times that you are available to meet and I can email you to confirm an appointment.</p>
TEXT (required):	<p><i>Principles of Instrumental Analysis - 7th Edition</i> by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 9781305577213) - <i>required</i></p> <p>NOTE: This is an excellent book that will serve any practicing chemist or scientist who uses modern chemical instrumentation. Note that I have NOT ordered this through the UVM Bookstore, since there are many (lower cost) options out there for you – this does require you to act in advance of the start of the semester in order to ensure you have your copy once class begins. Here are some good starting places:</p> <p>Amazon: https://www.amazon.com/Principles-Instrumental-Analysis-Douglas-Skoog/dp/1305577213 or Cengage (the publisher): https://www.cengage.com/c/principles-of-instrumental-analysis-7e-skoog/9781305577213PF/?filterBy=Student</p> <p>Make sure that you order a copy online in time to have it in-hand by the start of the course (January 13th).</p> <p>Over the past few years, the availability of freely accessible, high-quality reference materials on the web has reached a point (for the topics covered in this class) that, in addition to providing links to "optional additional information," for each unit we cover, I plan on providing links to <i>alternate readings</i> that are available online. These <i>alternate readings</i> have been chosen carefully and can serve as a supplement to the readings assigned in the text. I encourage you to explore both the readings in the text as well as those that I have identified on the web as <i>alternate readings</i> and hope you will find that they provide complementary value.</p>
GRADING:	<p>There will be three "hour" exams and one comprehensive Final Exam. The "hour" exams are <i>tentatively scheduled</i> for February 11th, March 17th, and April 14th (all Tuesdays). These exams will be administered starting at 7:00 p.m. (<i>in a room TBA</i>) on those dates and, although you will be allowed as much time as you would like, they should take no more than two hours to complete. The Final Exam is scheduled for Thursday, May 7th, 7:30 - 10:15 a.m. (<i>Votey 305</i>).</p>
	Your grade for the course will be determined as follows:

Exam I: 200 points
Exam II: 200 points
Exam III: 200 points
Final Exam: 400 points

TOTAL: 1000 points

LECTURE:	<p>A tentative lecture schedule (see the Course Master Schedule link) is available with links to lecture slides as well as detailed reading and problem assignment pages for each unit that we cover. It is important to realize that it is not possible to learn all that you need to know about Instrumental Analysis from just the text, lectures, supplemental readings, or problem sets. Rather, attention must be paid to <i>all</i> of these areas, as the material covered in each is designed to be complementary. I think that you will find that the problems in the problem sets (and exams!) will be easier to solve if you've attended the lectures and done the assigned readings.</p> <p>I encourage you to come to lecture having already read the assigned material, as I would prefer to spend as much of our class time <i>discussing</i> the material, answering your questions about the material and asking <i>you</i> questions about the material. Obviously, our time in class will only be meaningful if you've already read the assigned readings for that particular unit.</p> <p>I expect that you will attend each class, unless you are unable to do so due to circumstances beyond your control (e.g., illness, family emergency, etc.). While I do not take attendance (and I do post the lecture slides for each class online in Blackboard), what we do in class and what I say in class is designed to help you learn the material. Of course, everything I say or do in class will not necessarily be of immediate value to you, but we are a diverse class and I expect that you will find at least some of what we cover in class helpful at some point.</p> <p>While in class, I do expect that you will be respectful of both your fellow students as well as me, your instructor. This means that you will be paying attention, engaging with the material we cover, and participating in any class activities. If I ask the class a question, please do respond if you know (or suspect that you know) the answer. If I have said something that does not make sense to you, ask a question or ask me to clarify what I have said - remember that it is likely that you are not the only one in the room with that very same question, so do not be shy.</p> <p>The assigned readings and problems for the material we are covering are posted on the Blackboard site for the course and, by Sunday night each week, the Blackboard home page for the course will be updated with links to drafts of the lecture slides for the upcoming week's classes. Some might find it helpful to print out a copy of the lecture slides for you to use as a reference during class, while others might find it helpful to refer to the slides <i>after</i> class to clarify anything that might have been missed.</p>
COMPUTERS/CELL PHONES in the CLASSROOM:	<p>"So, can I bring and use my computer or a tablet or my cell phone to class?"</p> <p>Yes . . . and no. There are many good reasons to want to have access to these devices in class. Some folks like to take notes on them, or have the lecture slides that I post open and accessible for annotation or reference. These are appropriate and acceptable classroom uses of these devices. However, to reduce the temptation to either respond to text messages, emails, or other social media alerts, I expect you to put all of your devices in "airplane mode" during classtime. For computers or other connected devices, turn off Wifi; for phones or tablets that connect via cell networks, please also turn off access to those cell networks. For 50 minutes, I would like your full attention; if I see that you are not following this policy with your devices, you will lose the privilege of using them in class.</p> <p>(I do realize that there may be situations that arise in which you need to be available via cell phone - for example, if a family member is ill or is having surgery that day. If you are in this situation, please let me know before the start of class, so I understand when you receive that text message or have to leave the room to take an emergency phone call.)</p>
PROBLEM SETS:	<p>Problem sets will not be collected and are not "due" at any particular time -- it is in your best interests, however, to work the problem sets contemporaneously with the lecture material. Detailed solutions to the problems sets will be made available online on the course Blackboard site. Problems just like or very similar to those on the problem sets have a habit of finding their way onto exams, so it would be prudent of you to ensure that you can work the relevant problem set problems before you take one of the exams.</p>
BLACKBOARD SITE:	<p>All materials relevant to this course will be made available online at the Blackboard site for the course. All reading and problem set assignments and solutions will be made available ONLY on the Blackboard site (i.e., I will not hand out hardcopies during the semester). All lecture slides will be made available online as will old exams and solutions to this year's exams.</p>
Student Learning Accommodations:	<p><i>In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact the Student Accessibility Services (SAS) office on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan.</i></p> <p>Student Accessibility Services A170 Living/Learning Center 802-656-7753.</p> <p>access@uvm.edu http://www.uvm.edu/access</p>
Policy on Disability Certification and Student Support:	<p>http://www.uvm.edu/policies/student/disability.pdf</p>
Religious Holiday Policy Statement:	<p><i>Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time.</i></p>
Academic Integrity:	<p>This policy addresses plagiarism, fabrication, collusion, and cheating.</p> <p>http://www.uvm.edu/policies/student/acadintegrity.pdf</p>
Code of Student Rights and Responsibilities:	<p>http://www.uvm.edu/policies/student/studentcode.pdf</p>
Center for Health and Well-Being:	<p>http://www.uvm.edu/~chwb/</p>
Counseling and Psychiatry Services (CAPS):	<p>http://www.uvm.edu/~chwb/psych/</p> <p>If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380).</p> <p>If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at:</p> <p>https://www.uvm.edu/deanofstudents/student_advocacy/care_form</p>

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202001-10917 CHEM221A Instrumental Analysis

Course Master Schedule

Course Master Schedule

Course Schedule

Ok, realize that this is only a *tentative* schedule and can change at a moment's notice (with the update indicated here, of course!).

Approximate Dates	Topics	Assignments	Exams
January 13 , 15 , 17 , 24, 27	<i>Introduction; Signals and Noise</i>	Readings Problems	-
January 29, 31 February 3, 5, 7	<i>Electrochemistry</i>	Readings Problems	-
February 7, 10, 12, 14	<i>Optical Spectroscopy I: Intro/Background</i>	Readings Problems	Exam #1 7:00 pm Tuesday February 11th
February 19, 21, 24, 26, 28	<i>Optical Spectroscopy II: Instrumentation</i>	Readings Problems	
March 2, 4	<i>Optical Spectroscopy III: IR Molecular Absorption</i>	Readings Problems	-
March 6, 16, 18, 20, 23, 25, 27	<i>Optical Spectroscopy IV: Atomic Absorption and Emission</i>	Readings Problems	Exam #2 7:00 pm Tuesday March 17th
March 27, 30 April 1, 3, 6, 8	<i>Optical Spectroscopy V: Molecular Luminescence and Raman</i>	Readings Problems	-
April 8, 10, 13, 15, 17, 20, 22	Chromatography	Readings Problems	Exam #3 7:00 pm Tuesday April 14th
April 22, 24, 27, 29 May 1	<i>Mass Spectrometry</i>	Readings Problems	-
			Final Exam 7:30 am Thursday May 7th

Last Updated: Jan 12, 2020