Chemistry 3070 **Instrumental Analysis Syllabus** Fall 2020

Instructor
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Office Hours:
To be set in class
And by appointment

Course Meeting Times
MWF 12:15 – 1:20 pm
RLC 104

Laboratory
T 8:30 – 11:30 & 1:30 – 4:30
Sator Hall 216

Textbook
Harris, *Quantitative Chemical Analysis*, 9th Edition.

Additional readings from the current literature will routinely be assigned; these can be found on the course website.

Course Website
https://canvas.pointloma.edu/ Course: **CHE3070-1 FA20 - Instrumental Analysis**

Additional readings, practice problems, exam keys, and extra copies of class handouts will be available *only* on the course website.

Group Literature Presentations
A major objective for this course is for you to be able to think critically about real-world applications of chemical instrumentation. With this goal in mind, the class will conduct group discussions of journal articles describing recent applications in chemical instrumental analysis.

During each presentation day, as a *participant*, you'll receive credit for coming prepared to class and actively participating in the discussion. Once during the semester, as *presenters*, your group will receive credit for leading the discussion (including giving an 8-10 minute group presentation introducing the paper, leading a brief discussion of the instrumental method and relevant issues it brings up, and turning in a 1-2 page abstract).

Homework Problems
Homework problems will be assigned for each topic. The problems typically come from the textbook and will be turned in on canvas. The problems will be graded based on *participation* and *effort*.

Recommended Practice Problems
Periodically, sets of recommended problems will be provided to give you an opportunity to practice applying concepts from class and to give an idea of what you can expect on course exams. These problems are optional and will not be graded; the solutions will be posted on the course website.

Exams
There will be two exams (one hour each). See the course schedule for the dates of the exams.

Makeup examinations will be given only for excused absences. In such cases, appropriate documentation must be provided within two working days of the end of the excused absence.

Laboratory
Carefully-selected laboratory exercises will give you an opportunity to apply both theoretical and technical aspects of chemical instrumental analysis. Patience, critical thinking, and intellectual independence will serve you well in this laboratory!

Attendance and class participation
Regular attendance is crucial to success in Chem 3070 and you will be graded based on participation in class discussions and worksheets. Students who miss class for any reason are responsible for anything covered in that class (including announcements). Students who miss 20% of the total class meetings (4 meetings) may be dropped from the course. See Academic Policies in the Undergraduate Academic Catalog.

Grades
Your final grade will be determined as follows:

Group Literature Presentations	10%
Class Participation	10%
Homework	10%
Laboratory	30%
Exams (2)	40%
Total	**100%**

Academic Integrity
All students enrolled in this course are expected to adhere to the highest standards of academic integrity. If you are uncertain of the legitimacy of a particular action, you should contact the course instructor and request clarification.

- Collaboration with other students on the experiment, data collection, and data analysis for laboratory reports is encouraged, but the report should be your own.
- Use of any unauthorized aids, or aiding other students on exams is prohibited.
- Improper use of sources on lab reports and/or group literature abstracts is both illegal and unethical, and is grounds for a failing grade. (Note that it is possible to commit plagiarism even while citing the source. For clarification, see the instructor.)
- Assignments and exams from this course may not be committed to dorm repositories or otherwise be used to help future students.

A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

Academic Accommodations
If you have a diagnosed disability, please contact PLNU's Disability Resource Center (DRC) within the first two weeks of class to demonstrate need and to register for accommodation by phone at 619-849-2486 or by e-mail at DRC@pointloma.edu. See Disability Resource Center for additional information.

CHE3070 Goals	CHE3070 Outcomes
Students will:	Students will be able to:
1. learn how to select an appropriate instrumental method	a. identify strengths and limitations of instrumental methods (including UV-Vis absorption spectroscopy, atomic absorption and emission spectroscopy, IR spectroscopy, atomic and molecular mass spectrometry, and gas- and liquid-chromatography) b. compare instrumental methods with respect to precision, detection limit, linear range and selectivity c. employ standards in instrumental analyses, including internal and external standards, and the method of standard addition
2. understand the relationship between signal and noise	a. identify sources of noise (both general and method-specific) and strategies for reducing each type b. calculate the signal-to-noise ratio for a particular data set c. calculate the number of scans required to improve signal-to-noise ratio by a specified amount
3. understand the theory behind chemical instruments	a. draw a diagram to represent the energy changes during various types of spectroscopy b. convert between wavelength, frequency, wavenumbers, and energy of electromagnetic radiation c. describe the chemical phenomenon responsible for a particular signal d. convert between absorbance and % transmittance e. determine the concentration of an unknown sample using Beer's Law f. describe sources of deviation from Beer's Law and strategies for preventing or correcting the deviation g. using UV-vis, IR, and/or mass spectral data, predict the structure of an unknown molecule h. using experimental data, determine the column efficiency and resolution for a chromatographic separation
4. learn the components of chemical instruments	a. identify the major components in several types of chemical instrumentation and explain how they work b. draw a block diagram for a particular instrument or configuration c. justify the choice of a particular component, configuration, or experimental condition in an instrumental method
5. apply knowledge of instrumental analysis to real-world problems	a. perform UV-vis, ICP-OES, and IR spectroscopy; and gas- and liquid-chromatography and analyze the resulting data b. present an article from the recent chemical literature highlighting the instrumental method used, and write a brief abstract summarizing the key points from the article you presented c. write a concise and clear report describing the background, experimental procedure, results, data analysis, and conclusions of an instrumental analysis

Program Learning Outcomes: CHEM PLO 2 (HPLC) and ENVS PLO 3 (HPLC, ICP, IR, UV-vis) will be assessed directly by faculty laboratory instructors' observation of students' use of instruments.

Chemistry 3070 **Instrumental Analysis Schedule** Fall 2020

Day		Date	Topic	Reading* (Harris 9e)	Special Events	Lab
1	M	Aug 17	Introduction to chemical instrumentation			
2	W	Aug 19	Introduction to spectrophotometry: Beers Law, Measuring Absorbance	18.1–4		***Lab Discussion***
3	F	Aug 21	Applications of UV-vis spectroscopy, Absorption and Emission	18.5–7		
4	M	Aug 24	Applications of UV-Vis spectroscopy; Spectrophotometers: configurations and sources	19.1–3; 20.1–2		***In lab: UV-Vis***
5	W	Aug 26	Spectrophotometers: wavelength selectors and detectors	20.3–5	GLP topic deadline	
6	F	Aug 28	Infrared spectroscopy instrumentation	20.5		
7	M	Aug 31	Infrared spectroscopy instrumentation	20.5		***In lab: IR***
8	W	Sep 2	Noise	20.6		*UV-Vis Lab Due†*
9	F	Sep 4	**Exam 1*(UV-Vis, IR)***			
10	M	Sep 7	Intro to atomic spectroscopy	21.1-3		***In lab: ICP***
11	W	Sep 9	Atomic spectroscopy: sources	21.4–5	*GLP 1:*	*IR Lab Due†*
12	F	Sep 11	Atomic spectroscopy: wavelength selectors and detectors	21.6–7		
13	M	Sep 14	Introduction to mass spectrometry	22.1–3	*GLP 2:*	***In lab: GC***
14	W	Sep 16	Mass spectrometry instrumentation	22.4–5		*ICP Lab Due†*
15	F	Sep 18	Applications of mass spectrometry		*GLP 3:*	
16	M	Sep 21	Introduction to chromatography	23.1–5		***In lab: LC***
17	W	Sep 23	Gas chromatography (GC)	24.1–5	*GLP 4:*	*GC Lab Due†*
18	F	Sep 25	High performance liquid chromatography (HPLC)	25.1–3		
19	M	Sep 28	Applications of HPLC	25.4–5		***No lab***
20	W	Sep 30	**Exam 2 *(AS, MS, GC, LC)***			*LC Lab Due†*

* The assigned readings shown here are tentative. See canvas for up-to-date reading assignments.

† Lab reports are due at the start of the lab on your lab day.