CHEM 751 - SEPARATION SCIENCES - Spring 2022

Lectures: Tuesday & Thursday 7:00 - 8:15 pm

Instructor: Prof. Christopher R. Harrison
Office: GMCS-213E
Office hours: By appointment - **https://harrison-sdsu.youcanbook.me**
email: **charrison@sdsu.edu**

Textbook: No specific textbook is required for this course, however electronic resources will be posted to Canvas as needed.

Course Description

The aim of this course is to develop your expertise in understanding how to effect separations of a broad range of chemicals through contemporary chromatographic tools. This will include knowing how different chromatographic methods can exploit physico-chemical differences in analytes to effect a separation. We will also endeavor to understand the forces that limit separations and the factors that can be controlled to mitigate those detrimental effects.

The format of this course is going to be much closer to inquiry driven education rather than a lecture. You as a student in the course will have a significant role to play in determining the materials covered and the depth of that coverage. A rough schedule is posted in this syllabus, but the interests of the class will be allowed to dictate the depth of coverage, and may alter the schedule of the topics covered. At all times students are encouraged to present their own questions about aspects related to separation sciences and if appropriate, we as a class will work to answer those questions, making them part of the course materials.

The inquiry driven nature of the course is such that you will be provided with a series of questions for each class, which you are to try to answer within a small group of peers. After a defined period of time, the class will be brought back together and answers to those questions will be compared and debated. The consensus answers will be posted to a discussion page in Canvas, forming the backbone of the class “textbook”.

The reason why I am organizing the course in this manner is to help you as a student develop your knowledge of the material by having you actively engage with it. Lecturing at you is nowhere near as effective a tool for helping you learn materials, as having you discover the answer and discuss/debate it with peers. At its best, this can even result in you posing questions of your own, driving your curiosity, and ultimately knowledge of the subject material.

Learning Outcomes

Upon completion of this course the students will be capable of the following:

- Identify and describe the function of the key parts of contemporary chromatographic instruments, which may include GC, HPLC, CE, and others.
- Be capable of applying various retention theories to predict the elution of analytes from a given set of chromatographic separation conditions.
- Be capable of identifying the pertinent interactions and conditions in an electrophoretic separation system, as to be able to predict the migration of various analytes.
- Predict the relative elution strength of HPLC mobile phases.
- Describe how the electroosmotic flow in a capillary is generated and how it can be modified.
- Develop feasible strategies for obtaining the separation of mixtures of compounds, employing either various chromatographic techniques.

Course Materials

Electronic course materials will be made available through the course Canvas page. These will consist of digital handbooks, academic papers, and web links relevant to the course material.

Grading

The distribution of grades will be as described in the table below, with exams being the principle source of evaluation of each student's understanding of the course materials.

	Percentage
Exam 1	25%
Exam 2	25%
Final Exam	30%
Participation	10%
Assignments (2)	10%

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

Participation will be evaluated as a measure of individual contributions to in-class discussion, writing/editing/commenting in the group produced study guide. Periodic updates to approximate participation scores will be distributed (likely with the exams) to allow for individuals to assess their level of participation.

In addition there will be a semester long assignment for students to maintain a **journal diary**. Students are to keep an eye on the latest publications from a selection of journals that focus on separation sciences (list below). Students should be identifying one article every two weeks (7 total articles over the course of the semester) that are of interest to them (but must focus on some form of a separation technique). The student should read the article of interest and provide a brief summary of the

article, highlighting the aspect of interest to them, the key innovation in the research, and any significant knowledge that they gained from reading the article. The journal diary should be written in Google Docs and shared with Dr. Harrison. The diary will be reviewed at the mid-point and the end of the semester, each review will be worth 5% of the total course grade.

If you are unable to find any current articles of interest in the recently published issues of the journals below you may look in the archives for other articles, but they must have been published within the past 12 months. If you wish to use a journal outside of those suggested below, or if you unsure if the article has a sufficient focus on separation sciences ask Dr. Harrison for guidance.

Suggested journals

- Electrophoresis
- Journal of Separation Sciences
- J. Chrom A.
- Analytical Chemistry
- Analytical Bioanalytical Chemistry
- Analyst
- Lab on a Chip
- Analytical Methods
- Talanta
- Analytica Chimica Acta

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.
- 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, or an estimate of the likely exam grade will be made based on all other exams taken in the course during the semester (comparing the student's performance to that of all their classmates as a benchmark).

Course Schedule

Week		Dates	Topics
1	**-**	**January 20**	Chemical Separations
2	**January 25**	**January 27**	Generic instrumentation Challenges in maintaining a separation
3	**February 1**	**February 3**	Forces working against separations
4	**February 8**	**February 10**	Gas Chromatography
5	**February 15**	**February 17**	GC - retention index and 2D separations
6	**February 22**	**February 24**	**Exam 1**
7	**March 1**	**March 3**	Liquid Chromatography
8	**March 8**	**March 10**	HPLC - Fluid Flow, Pressure, Diffusion
9	**March 15**	**March 17**	HPLC - Columns
10	**March 22**	**March 24**	HPLC - Retention
-	**March 29**	**March 31**	**Spring Break**
11	**April 5**	**April 7**	**Exam 2**
12	**April 12**	**April 14**	Capillary electrophoresis
13	**April 19**	**April 21**	CE - Electrophoresis & Electroosmotic Flow
14	**April 26**	**April 28**	CE - Control of EOF
15	**May 3**	**May 5**	CE - Separation Techniques

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.

Preferred Names & Pronouns

Any student who wishes to be addressed by a name other than what is presented in Canvas is encouraged to contact Dr. Harrison via email with the name you wish to use in this course. Similarly, if you have preferred pronouns that you wish to be addressed by please contact Dr. Harrison.