

ADVANCED RADIOCHEMISTRY

Spring 2019

Instructor: Professor Christopher Dares (cdares@fiu.edu)

Schedule: TR 8:00 am – 9:15 am; in GC276

Office: CP338A

Office Hours: Wednesdays 9:30 – 10:30 am, or email for an appointment

Textbook: None required.

Additional: “Radiochemistry and Nuclear Methods of Analysis”, Ehmann & Vance, John Wiley & Sons.
“Nuclear and Radiochemistry” by G. Friedlander, J. Kennedy, E. Macias, and J. Miller.
“Radiochemistry and Nuclear Chemistry” by Gregory Choppin, Jan-Olov Liljenzin, Jan Rydberg, and Christian Ekberg, 4th Edition
“Introduction to Nuclear Science” by Jeff C. Bryan, 2nd Edition

Course Website: faculty.fiu.edu/~cdares/teaching.html

COURSE DESCRIPTION

CHS 6111 provides an in depth analysis of the diverse world of radiochemistry. The course probes nuclear reactivity by examining nuclear interactions and reactions to understand many nuclear applications. These applications include the nuclear energy, nuclear forensics, nuclear medicine, environmental radiochemistry, and the chemistry of actinides.

PREREQUISITE

Graduate student status and CHS5110.

LEARNING OBJECTIVES

The goal of the course is to facilitate your understanding of the origin, properties, and interactions of radiation, as well as the properties and chemistry of radioactive elements. This includes highlighting the relationship between fundamental science, and relevant cutting-edge applications. During the course, students will:

1. **Become familiar with the origin and properties of unstable elements**
2. **Understand radiation detection techniques, and determine dose**
3. **Become familiar with applications of nuclear and radiochemistry**

TENTATIVE SCHEDULE (CHANGES MAY OCCUR)

Class#	Date	Topic
1	Jan 8	Syllabus
2	10	Nuclear Models
3	13	Nuclear Properties
4	17	Nuclear Transitions
5	22	Nuclear Reactions Part 1
6	24	Nuclear Reactions Part2
7	29	Interactions of Radiation with Matter – Heavy Charged Particles
8	31	Interactions of Radiation with Matter – Beta-Particles
9	Feb 5	Interactions of Radiation with Matter – Gamma and Neutron
10	7	Lit Review – Presentation Group 1
11	12	Lit Review – Presentation Group 2
12	14	Health Physics – Quantifying Radiation
13	19	Health Physics – Biological Effects
14	21	Health Physics – Exposure, Control, and Protection
15	26	EXAM 1
16	28	Nuclear Energy
17	Mar 5	Nuclear Weapons
18	7	Nuclear Fuel Cycle Part 1
	12	NO CLASS – March Break
	14	NO CLASS – March Break
19	19	Nuclear Fuel Cycle Part 2
20	21	Actinide Chemistry
21	26	Actinide Coordination Chemistry Part 1
22	28	Actinide Coordination Chemistry Part 2
23	Apr 2	Nuclear Medicine – Diagnosis
24	4	Nuclear Medicine - Treatment
25	9	Lit Review Presentation – Part 1
26	11	Lit Review Presentation – Part 2
27	16	Lit Review Presentation – Part 3
28	18	Lit Review Presentation – Part 4
		FINAL EXAM – 5:00 – 7:00 pm (CP103)

GRADING

Your course grade will be determined from four components:

I.	Presentation 1	10 %
II.	Presentation 2	20 %
III.	Written Report	10 %
IV.	In-class Exams (1)	30 %
V.	Final Exam: TBD	30 %

EXAMS

One in-class exam will be given. One final exam will be given. The final exam will be cumulative, covering all of the material from the semester. Note that the final exam date is fixed and cannot be changed; make sure that your schedule can accommodate the exam time.

MISSED EXAM POLICY

No makeup exams will be given. In the case of a missed in-class exam, your percentage score on the Final Exam will be used instead. The Final Exam is cumulative, so the material covered on the missed exam will be (partly) included in the Final Exam. If a conflict or medical problem arises, feel free to contact the instructor to discuss the situation.

PRESENTATIONS

Two presentations will be presented by each graduate student. These presentations will take place during class time. For the first presentation, each graduate student will be required to choose a peer-reviewed manuscript in an area of interest to the class. After approval by the course instructor, the student will prepare a 20 min presentation based on the article. Tentatively, these presentations will take place on Feb 7 and 12. The presentation is expected to include pertinent background information required to understand the background work surrounding the article, and to highlight the impact that the work has on its field through discussion and interpretation of the results. Students are expected to circulate the articles to members of the class at least 5 days prior to their presentation. The second presentation will include a 30 min presentation on an area of radiochemistry of interest related to current research. Material can include multiple manuscripts, textbooks, or other sources. Topics must be approved by the course instructor. In addition to the presentation, students will prepare an article in the form of a review on the same topic which is to be submitted by Apr 9. Presentations are tentatively set for Apr 9, 11, 16, and 18. Evaluation of each presentation will be completed by both the course instructor, and fellow students. It is therefore imperative that you are present for each and every presentation.

NOTES AND CLASS TIME

The course will be taught through presentation slides projected on a screen and board work. Slides will be posted on the website ahead of time.

RESEARCH EXPOSURE

CHS6111 strives to delve deeply into both historical and current topics related to nuclear and radiochemistry, and to provide in a greater context, ongoing research at FIU and the resulting technology products that results from research efforts around the world. Please visit the course website at to learn about how you might engage in research, scholarship and creative performance while you are at FIU. Projects introduced during the semester will involve research into the primary chemical literature and the development of interacting learning tools. If you are interested in performing undergraduate research, contact the instructor to learn more.

STUDYING

The course covers a wide range of chemistry. Review your notes daily (don't wait until the night before an exam to study!) and work practice problems from textbooks. Studying in groups is encouraged, but each student must turn in their own independent problem sets. Make sure you are not relying on others in your study group: they won't be there to help you on the exam. The website will feature a bulletin

board where you can post questions that Prof. Dares or your classmates can weigh in on. Please note: Prof. Dares is unable to respond to e-mails regarding course content; please do e-mail about setting up a one-on-one meeting to discuss any aspect of the course.

COURSE WEBSITE

Please refer to the course website (faculty.fiu.edu/~cdares/teaching.html) for all class assignments and announcements as well as the syllabus and exam schedule.

CLASS CITIZEN ETIQUETTE

Please be respectful: **turn off cell phones and computers and focus on the material.** If you use your computer/tablet, please sit at the back so as to not interfere, disrupt, or distract others. Students whose behavior is detrimental to the learning environment will be asked to leave.

EMAIL POLICY

Prof. Dares is looking forward to hearing from you! Before you click “send” please read the following guidelines: (a) please be sure that your subject starts with the header “CHS6111”; and (b) please refrain from asking content-based questions. Radiochemistry covers a variety of complex topics, none of which are easily addressed in writing over e-mail. These topics are best addressed in person, at office hours. If the normal office hours conflict with your schedule, please e-mail to set up an appointment.

HONOR CODE

The Honor Code is the cornerstone of academic integrity at FIU. Students are expected to uphold and abide by the Honor Code. **All suspected Honor Code violations will be reported promptly. No collaboration is permitted on graded work** because these assignments will be used to determine academic progress. When collaboration is permitted an explicit statement encouraging teamwork will be made. As discussed elsewhere in the syllabus, studying in groups is encouraged; however, graded assignments must be your own independent work.

HOW TO SUCCEED IN THIS COURSE

- **Come to class prepared.** This is a no-brainer. Read the assigned textbook chapters or handouts before lecture. Most class sessions will start with a clicker question about the assigned reading.
- **Study in groups.** Study groups are effective when everyone collaborates and works hard. Study groups are encouraged, but remember that each student must submit his or her own work. Beware of false confidence when the group arrives at answers that you don’t fully understand!
- **Get help early.** If you are having problems with the material, seek help early in the semester. Halfway through the course is way too late.

DISCLAIMER

The instructor reserves the right to make changes to the syllabus, including assignment and test dates (excluding the officially scheduled Final Exam), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules