CE 597
Environmental Analytical Chemistry
Fall 2024

INSTRUCTOR: Dr. Amisha D. Shah

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Office Hours: MWF (11:30-12:30 pm); other times by appt.

COURSE TIME AND LOCATION:

Class time: MWF 3:30 pm – 4:20 am
Class location:

COURSE DESCRIPTION:

This course will focus on evaluating how specific analytical techniques can be used to assess the composition of solutions and materials of environmental concern in both clean and complex matrices. A discussion of different analytical tools including (i) spectrophotometry, (ii) liquid chromatography, (iii) gas chromatography, and (iv) mass spectrometry will be provided. Additional material will cover the computational and statistical tools needed for assessing analytical data. Exposure to how to the analytical tools work and data processing will be introduced intermittently to compliment lecture topics. The class though will culminate in a literature review and presentation in which various analytical methods will be cross-compared to assess contaminants of concern in various types of environmental matrices.

REQUIRED MATERIAL:

No material will be required. Recommended textbook is *Quantitative Chemical Analysis*, 8th edition, by Daniel C. Harris, W.H. Freeman and Company (ISBN: 978-1429218153)

SUPPLEMENTARY MATERIAL:

Many important files and useful information will be posted on Brightspace. Please check Brightspace periodically (at least once a week). Additional information will also be provided through your *university e-mail account*. It is advised that you check this e-mail account frequently as well to receive important updates regarding this course.

COURSE PREREQUISITES:

There are no prerequisites for this course. It is recommended that CE 554 (Aquatic Chemistry in Environmental Engineering) be taken in order to have working knowledge of aquatic chemistry principles.

LEARNING OUTCOMES:

After completing this course, students should be able to:

- Explain the fundamental concepts behind how each analytical instrument works

- Identify the physical and/or chemical properties needed for compounds to be measured by a specific analytical instrument
- Identify the advantages and limitations of each analytical method discussed in class
- Use appropriate computational and statistical tools to assess analytical data
- Design troubleshooting strategies for common systematic errors associated with instrumental operations
- Critically evaluate peer-reviewed literature that applies existing and novel analytical tools to investigate important scientific questions in the environmental science and engineering fields.
- Develop excellent written and spoken communication skills

COURSE OUTLINE

Classes		Approximate Exam Coverage		
		#1	#2	Final
1	Introduction	■		■
2	Error, Statistics	■		■
3	Calibration Curves, QA/QC, Standard Addition	■		■
4	Buffers	■		■
4	Spectrophotometry	■		■
4	Fundamentals of Chromatography		■	■
6	Liquid Chromatography		■	■
5	Gas chromatography		■	■
9	Mass spectrometry and tandem mass spectrometry			■
3	Student presentations			■

EVALUATION AND GRADING

Problem Assignments: **You will be assigned a "mini" problem set each week on Friday, which will be due on the following Wednesday. Since a mini problem set will be assigned each week, we will have a total of ~12 min-problem sets due. Three of the problem sets that hold the lowest grade after the semester is completed will be dropped.** All problem sets should be completed outside of the classroom. Students are encouraged to work on these problem assignments in a collaborative setting, but copying of each other's problem assignments is strictly prohibited.

Exams: Three in-class exams will be given, two during the semester and one final exam. No make-up exams will be given. If you miss a mid-term exam due to an unavoidable (and documented) reason, your score on the final exam will also be your score for the missed midterm exam.

Student Team Project: The aim of this project is to perform a literature to complement the understanding of the various analytical tools used to analyze various chemicals/contaminants that

were discussed during the semester. The main goal is to understand if other analytical tools can be measured the same compounds, how they are measured in different matrices, and the overall pros and cons for each method. ***The project will culminate in a team presentation that should compare and contrast the analytical methods used for a particular set of contaminants.*** The team will be comprised of 3-4 members and each team's presentation will be no longer than 20 min in length. More details regarding the topic and specific objectives will be provided at a later date.

Re-grade Policy

If you believe a grading error has been made on an exam or an assignment, you must notify the instructor via email within 24 hours of receiving the grade. Within this e-mail, please explain why you have requested a re-grade for the exam or assignment. Once the re-grade has been accepted, the instructor reserves the right to carefully re-grade the entire exam or assignment.

Late Policy

Problem assignments will be completed outside of class and will incur a **20% deduction for each business day (24 hrs) it is late**. If the problem assignment is submitted **more than three (3) business days (72 hrs)** after it is due, **it will not be accepted**. If you plan to submit the assignment after the deadline, please inform the instructor as soon as possible.

Evaluation Item	Contribution to Final Grade (%)	Date
Mini Problem Sets (~12)	35	
Exam 1	15	Sept 27
Exam 2	15	Nov 1
Final Exam	15	TBD
Team Project presentations	20	Dec 2 to 6

Final Course Grade

This class will be graded on a sliding curve. This is done due to the relatively small size of the class but also meant to deter competition between the students.

Attendance

It is strongly recommended that students attend each class lecture session. Some material covered in class will not be covered in the textbook. All class material can be included for the exams. If a class is missed, it is encouraged that you contact another class member to obtain copies of any missed material. During class, no electronic devices (e.g. laptops, cell phones, etc) are permitted unless specifically authorized by the instructor.

If a student anticipates missing class, please notify the instructor prior to the class as far in advance as possible. If the missed class is not anticipated due to an emergency situation or if it is not possible to notify the instructor prior to the class, please contact the instructor as soon as possible by e-mail or contact the CE business office. If none of these options are possible due to

special circumstances, such as cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students.

The complete policy and implications about attendance policies can be found at:
http://www.purdue.edu/odos/services/classabsence.php

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

Grief Absence Policy

If a student requires a time of bereavement, Purdue provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). The GAPS policy states that: students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for misses assignments or assessments in the event of the death of a member of the student's family.

Academic Integrity

Every assignment, quiz, or part of them that you turn in under your own name must be completed by you personally. If you turn in homework copied from someone else or allow others to copy your work, this will be considered automatic grounds for failing the course. Therefore, it is of greatest importance that the academic integrity of each student be maintained in order to secure the value of their education and to secure the high quality of learning provided at Purdue. The instructor will take all measures necessary to prevent and report academic violations.

In general, Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

A student's guide for academic integrity is available at:
http://www.purdue.edu/odos/aboutodos/academicintegrity.php

Copyrighted Material

Please note that all materials presented by the instructor are protected by copyright unless the instructor has stated otherwise. Copyrighted materials include lectures, notes, and other material presented in class or part of the course. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Violent Behavior Policy

Purdue prohibits violent behavior and is committed to providing a safe and secure campus environment for its community members. Additional information regarding this policy can be found at: http://www.purdue.edu/policies/pages/facilities_lands/i_2_3.shtml

Students with Disabilities:

If you have a disability that requires special academic accommodation, please make an appointment to speak with me within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student's responsibility to notify the Disability Resource Center (http://www.purdue.edu/drc) of an impairment/condition that may require accommodations and/or classroom modifications.

Mental Health/Wellness Statement:

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours. CAPS also offers resources specific to COVID-19 on its website. Topics range from "Adjusting to the New Normal" to "How to Talk with Professors about Personal Matters."

Basic Needs Security:

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it relates to COVID-19, students may submit requests for emergency assistance from the Critical Need Fund

Emergency Preparation:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Nondiscrimination Policy

The nondiscrimination policy for Purdue is as stated: Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Syllabus Changes

While the instructor will make every effort to adhere to the syllabus in its current form, specific items of this syllabus may change during the semester. All changes will be posted through Brightspace or will be reported to the student through their university e-mail account.