ENV E 220 Environmental Chemistry for Engineering

Fall 2024 - September 03 to December 09

Class time: Monday, Wednesday, Friday 10:00-10:50 Location: ETLC E1-018

Instructor:

Olubukola Alimi, PhD

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Donadeo Innovation Centre For Engineering 7-237
Office Hours: Wednesdays 2:00 - 3:30 pm

Course Description:

*3.8 (fi) (either term, 3-0-3/2) Survey of basic principles in analytical, inorganic, and organic chemistry with emphasis on environmental engineering applications. Laboratory measurements related to water quality.

Prerequisites: CHEM 105

Course synchronous and asynchronous content delivery schedule:

All lectures and labs will be in person and synchronous. The midterm and final exams will also be in person and synchronous. Assignments will be asynchronous.

Land Acknowledgment:

The University of Alberta acknowledges that we are located on Treaty 6 territory, and respects the histories, languages, and cultures of First Nations, Métis, Inuit, and all First Peoples of Canada, whose presence continues to enrich our vibrant community.

TA Information:

Calvin Chung (thchung@ualberta.ca)
Judy Kahkeci (maskoun@ualberta.ca)
Md Rashid Al Mamun (mdrashi1@ualberta.ca)

Lab Sections:

Section	Day	Time	Location
LAB D11	Monday	14:00 - 16:50	NREF 2-010
LAB D12	Monday	14:00 - 16:50	NREF 2-010

Course Objectives & General Content:

Environmental engineers must be able to draw on their knowledge of chemistry in order to understand the causes and effects of environmental problems, and to be able to design solutions to these. The objectives of the EnvE 220 course, one of your first courses in environmental engineering, are therefore to:

• learn how concepts of inorganic chemistry learned in first year undergraduate chemistry courses (such as acid base, complexation and redox equilibrium problems) can be applied to solve environmental engineering problems;
• become familiar with the various classes of organic compounds of environmental significance and how these may behave in the environment;
• learn the principles of a few analyses used in environmental engineering practice through a series of laboratory exercises;
• lay the foundation in chemistry that will be required for subsequent courses in environmental engineering.

Achieving these objectives will give students an accurate impression of the work environmental engineers do, prepare you for the next higher level of environmental engineering courses and give you some basic tools to use in your summer or co-op jobs.

Learning Outcomes:

By the end of this course, students should be able to:

1. Extrapolate concepts of inorganic chemistry learned in first year undergraduate chemistry courses and apply them to solve environmental engineering problems.
2. Classify and express the properties of water (ions, alkalinity and hardness) in an environmental engineering context.
3. Investigate how contaminants behave in the environment based on principles of phase equilibrium and partitioning, chemical equilibrium and gibbs free energy, acid-base equilibrium, complexes and metal solubility, and redox.
4. Perform water chemistry analyses commonly used in environmental engineering practices through a series of laboratory exercises.
5. Collect and evaluate the laboratory data by writing a laboratory report.

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Assignments	Asynchronous	see attached schedule	10%
Lab	Synchronous	see attached schedule	30%
Midterm exam	Synchronous	Oct 18, 2024	20%
Final exam	Synchronous	TBD	40%
In-class quizzes (bonus)	Asynchronous	Random throughout course	2%

The Faculty recommended grade point average for a 200 level course is 2.8. Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

Term Work

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work, shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

Additional Notes

Please familiarize yourself with the University of Alberta's COVID-19 information page, in particular, with the information related to what you should do if you are unwell (see https://www.ualberta.ca/covid-19/campus-safety/stay-home-when-you-are-unwell.html).

Please note the following:
- Lectures in this course will not be recorded. Completed lecture notes and completed in-class problems will be available on eClass.
- Late assignments will not be accepted but only five of the six assignments will be counted towards your final assignment grade.
- If you miss the midterm exam because you are ill, the percentage for the midterm exam will be placed on the final exam.

Calculator Policy

Only approved non-programmable calculators are permitted in examinations. Any calculator taken into an examination must have a sticker identifying it as an acceptable non-programmable calculator (gold sticker). Students can purchase calculators at the University Bookstore with the stickers already affixed. Calculators purchased elsewhere can be brought to the Student Services where the appropriate sticker will be affixed to the calculator.

Text and References (Mandatory):

Sawyer, C.N., McCarty, P.L., Parkin, G.F. 2003. Chemistry for Environmental Engineering, Fifth Edition, McGraw-Hill, Inc., New York, NY, 752 p.

Website:

eClass

Previous Examples of Evaluative Materials:

The eClass website will be used to provide students with lecture notes, completed lecture notes, assignments, assignment solutions, announcements, sample midterm and final exam questions, and additional material (reading material, useful websites, frequently asked questions, student Q&A forums). Completed lecture notes and assignment solutions should not be printed.

Lab Information:

Lab Topic	Date
Lab 1: Lab 1: Introduction and Lab Safety (Sections D11 and D12)	2024-09-09
Lab 2: Lab 2: Hardness (Section D11)	2024-09-16
Lab 3: Lab 2: Hardness (Section D12)	2024-09-23
Lab 4: Lab 3: Alkalinity (Section D11)	2024-10-07
Lab 5: Lab 3: Alkalinity (Section D11)	2024-10-21
Lab 6: Lab 4: Dissolved Oxygen (Section D11)	2024-10-28
Lab 7: Lab 4: Dissolved Oxygen (Section D12)	2024-11-04
Lab 8: Lab 5: Chemical Oxygen Demand and Total Organic Carbon (Section D11)	2024-11-18
Lab 9: Lab 5: Chemical Oxygen Demand and Total Organic Carbon (Section D12)	2024-11-25

Students will undergo WHMIS safety training as a part of this course and are expected to follow appropriate lab safety procedures at all times.

Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!

Env E 220 Lecture Schedule

Date	Lecture	Topic	Suggested Reading from Recommended Textbook	Assignments and Deliverables
Sept. 4	1	Introduction		
Sept. 6	2	**Unit 1** - Properties of water and expressing concentration	Chapter 1 (all), Sections 2.1, 2.2	
Sept. 9	3			
Sept. 11	4			
Sept. 13	5	**Unit 1** - Ions, hardness, alkalinity	Chapter 18, 19	
Sept. 16	6			
Sept. 18	7			
Sept. 20	8	**Unit 2** - Phase equilibrium and partitioning	Sections 2.9, 2.10, 3.12	Assignment 1 due
Sept. 23	9			
Sept. 25	10	Guest Lecture		
Sept. 27	11			Assignment 2 due
Sept. 30	***Truth and Reconciliation Day (no class)***			
Oct. 2	12			
Oct. 4	13	**Unit 3** - Chemical equilibrium	Sections 2.11 to 2.15; 3.1 to 3.3	
Oct. 7	14			
Oct. 9	15			
Oct. 11	16			Assignment 3 due
Oct. 14	***Thanksgiving (no class)***			
Oct. 16	17			
Oct. 18	***Midterm (in class)***			
Oct. 21	18	**Unit 4** - Acid-base chemistry	Sections 4.1 to 4.7	
Oct. 23	19			
Oct. 25	20			
Oct. 28	21			
Oct. 30	22			
Nov. 1	23			Assignment 4 due
Nov. 4	24			
Nov. 6	25	**Unit 5** - Complexes and metal solubility	Sections 2.13, 2.15, 4.8, 4.9	
Nov. 8	***Fall Break (no classes)***			
Nov. 11				
Nov. 13				
Nov. 15	26			

Nov. 18	27			
Nov. 20	28			
Nov. 22	29	**Unit 6** - Redox and pE - pH diagrams	Sections 2.7, 3.9, 4.10	Assignment 5 due
Nov. 25	30			
Nov. 27	31			
Nov. 29	32	**Unit 7** - Organic chemistry	Sections 5.1 to 5.32	Assignment 6 due
Dec. 2	33			
Dec. 4	34			
Dec. 6	35	Final exam review		
TBD	***Final Exam***			

University and faculty policies

Respect and professionalism

The Faculty of Engineering is committed to fostering and protecting an equitable, inclusive, and respectful work and study environment in line with University of Alberta policies and professional engineering industry standards.

The faculty prepares students to uphold industry standards to become a Professional Engineer (P.Eng). Therefore, respect, professionalism, and accountability must be upheld within the Faculty of Engineering and the University of Alberta.

Academic integrity

All students are expected to follow the University of Alberta's Student Code of Behaviour and Student Conduct Policy. The faculty expects an environment free of harassment, discrimination, and bullying. We encourage you to talk to the Office of Safe Disclosure and Human Rights about experiences, questions, or concerns. Additional resources and support for students are attached below.

Engineering students studying in the province of Alberta must also follow the Code of Ethics set by the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

Course outline policies, course requirements, evaluation and grading information can be found in the University Calendar.

Safety during learning activities

In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control.

Anyone found to be unable to function safely in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors in alignment with the Student Code of Behaviour and Student Conduct Policy. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of unsafe work.

Audio and video recording

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan.

Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Only those items specifically authorized by the instructor may be brought into the exam facility. Students must not bring any unauthorized electronic device into an examination room, including cell phones or other devices.

Student services and support

Health & Wellness Support

Counselling and Clinical Services

Free, short-term, appointment-based counselling and psychiatric services. Also offers drop-in workshops. Book an initial consultation. Visit uab.ca/CCS to learn more.

Wellness Supports Social Workers

Free one-on-one support for students in the areas of housing, finances, academics, personal wellness, life skill development, family dynamics, system navigation, and any area of life where there is a desire to invite change. Visit uab.ca/wellness to learn more.

Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling. Visit uab.ca/UASAC to learn more.

The Office of Safe Disclosure & Human Rights (OSDHR)

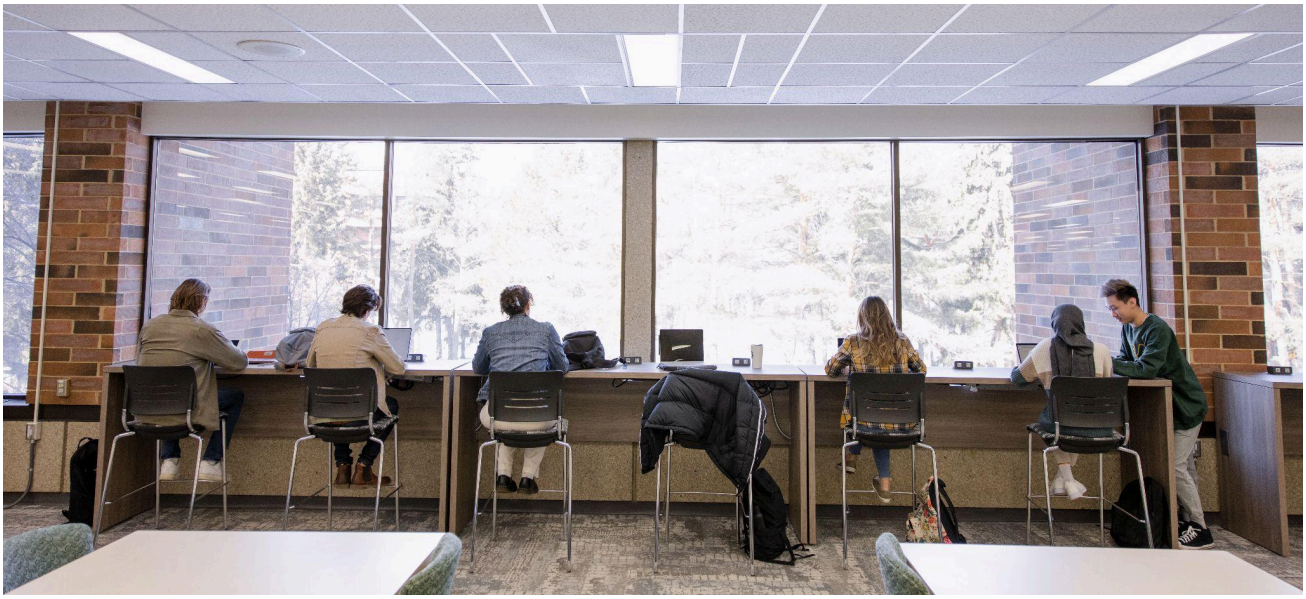
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

HIAR (Helping Individuals at Risk)

If you're worried about someone, contact HIAR, who can help assess risk and connect individuals to support. Learn more at uab.ca/HIAR.

Immediate External Supports

Health Link Alberta: 811
Suicide Crisis Helpline: 988



Academic support

Academic Success Centre
Access to a variety of services to maximize your academic success. Learn more at uab.ca/ASC.

Accessibility Resources
Connects students with disabilities to accommodations. Learn more at uab.ca/Access under accommodations + accessibility.

Decima Robinson Support Centre
Academic support for 100- or 200-level introductory calculus, linear algebra and statistics courses. Visit uab.ca/DSC to learn more.

Engineering Student Success Centre
The Faculty of Engineering provides drop-in tutoring for first-year courses. Visit uab.ca/ESSC to learn more.

Office of the Student Ombuds
Call for complex problems and conflict mediation. Learn more at uab.ca/ombuds.

Financial support

Student Service Centre

For awards and other funding support. Learn more at uab.ca/ask.

Campus Food Bank

The Campus Food Bank Society is an independent charity supporting University of Alberta students, faculty, staff, and alumni for up to five years. For additional information visit their website at campusfoodbank.com.

Additional Information Related to the Laboratory

Grading for Laboratory

Lab reports	70 % (4 lab reports)
Lab quizzes	20 % (5 quizzes)
Lab book	10 % (to be handed in with Lab 5 report)
TOTAL	100% (30% of the overall course grade)

Laboratory Policies

- **Teams of up to three students** each will prepare and submit a laboratory report for each of the five lab exercises. **Teams will be specified by the lab instructor(s)**. Students may work as larger groups in the laboratory and may share data sets, however, reports must be submitted in teams as specified by the instructor(s). The teams will change with each report.
- Laboratory reports are to be handed in directly to the EnvE 220 assignment box on the 2nd floor of NREF by **noon** (12:00) on the specified date (see lab schedule). Late reports will be penalized 20% per day.
- If you miss a lab without providing documented medical or compassionate evidence, you will receive a mark of zero for that lab. If you have evidence to support the missed lab, you will then be eligible for all marks, provided that you submit a lab report (which you have contributed to).

Laboratory Safety

You will be working with and near dangerous chemicals and bio-hazards. **Safety glasses and gloves will be provided and must be worn. Lab coats are mandatory. Use of contact lenses is not allowed. Food or drink is not allowed in the lab. Open toed shoes or sandals are not permitted in the lab.**

Requirements for Lab Reports

The lab reports should be written using full sentences, technical and correct English, on a word processor, and contain the following parts:

Cover Page	Include the course title and number, title of the lab, all group members' names, student numbers, and the date on which the report was completed.
1.0 Introduction	State the purpose of the test, give some background information on the tests (should be only a paragraph).
2.0 Methodology	Summarize the pertinent safety procedures. Indicate any changes to the procedure described in the lab handout that was made during your lab, and describe the samples analyzed. To avoid unnecessary duplication, you may simply refer the reader to Appendix I (or A) for the full procedure and include your lab handout as the first appendix at the end of the report.
3.0 Results	Clearly present final results (i.e. reduced data) in tabulated and/or graphed form (as appropriate). Each table or graph should be introduced with one or two sentences. (e.g. Table 1 contains the results of the Total Coliform test performed on a sample of North Saskatchewan river water). All tables and figures require captions, with table captions placed and centred above the table and figure captions, placed and centred below the figure.
4.0 Discussion	Clearly provide a description of the results; an explanation of their significance; a comparison of the results with typical or expected values (if appropriate); a discussion of errors which occurred during the performance of the test; etc. Include any answers to the "Discussion Questions" in the lab handout. ***Note: this is the most important part of the lab report!***
5.0 Conclusions	Summarize the results of the test or experiment. This section should not contain any new information.

References	List citations referred to in the body of the report.
Appendices	Use a separate appendix for each of the following: lab handout, procedure worksheets; raw data; sample calculations. Appendices should be referred to in the body of the text.

Lab Report Length

There is no minimum or maximum length for the laboratory reports, but a typical report should be about 3 to 5 pages (not including the cover page), depending upon the number of tables or graphs. Quality should be emphasized over quantity. A good report is complete yet concise.

Mark Distribution for Lab Reports

The following mark distribution will be used by the teaching assistant to grade lab reports:

ELEMENT	MARKS
Cover Page	2
Introduction	4
Methodology	3
Results	5
Discussion	8
Conclusions	3
References	3
Appendices	2
Overall presentation*	10
Peer evaluation**	5
TOTAL	**45**

* Marks will be awarded for the overall presentation of the lab report. Examples of some elements that are considered in awarding these marks are: proper presentation (i.e. use of appropriate headings, figure captions, table titles; appropriate section headings, subheadings (if required) and numbering; overall neatness; etc.), correct spelling and grammar, appropriate use of technical English and appropriate use of referencing and in-text citing.

** Since reports are completed in groups, each student will have the opportunity to grade their group members on their participation in the report. The peer evaluation grade will reflect the average of the grades given to you by your peers. The peer evaluation will be confidential.

Lab Quizzes

You are expected to read the lab handout and the relevant textbook sections in advance of the laboratory session. You will not be quizzed on the standard methods, however, you might find this useful for addressing some of the discussion questions.

Maintaining a Lab Book

Good record keeping is essential to professional laboratory practice and research and, even in this age of computers, the laboratory notebook is the primary method of recording information. In fact, the laboratory notebook becomes a legal document that may be called upon in legal proceedings. The students will practice the art of good record keeping by maintaining a laboratory notebook. Each student must obtain a hard covered record book to record all data and notes collected during the lab

- The lab book must have a table of contents on the first few pages and each page will be numbered and dated.
- For each lab exercise, there should be a title, a brief statement of the objective of the lab and a summary of the key steps involved (this can be in the form of a flowchart)
- Any tables required for data collection should be prepared before the lab.
- Use pen to record data and notes, and do not erase erroneous entries, simply cross them out.

- Record all measurements made in the lab. Also record any relevant or unusual observations (i.e. the solution turned blue)
- Even though lab exercises may be performed in groups, **each student must record all measurements required for the exercise.**
- At the end of each lab, each student must have their lab book checked by the instructor, lab technician or the TA. A grade will be assigned to lab book at the end of the course.

Lab Schedule

LAB	DATE	REPORT DUE DATE	TEXT BOOK REFERENCE	STANDARD METHODS
Lab 1: Introduction and Lab Safety	Sept. 9 (D11) Sept. 9 (D12)	No report*	Chap. 9, 10.1-10.3	None
Lab 2: Hardness	Sept. 16 (D11) Sept. 23 (D12)	Sept 23 (D11) Oct. 1 (D12)	Chap. 19	2340
Lab 3: Alkalinity	Oct. 7 (D11) Oct. 21 (D12)	Oct. 15 (D11) Oct. 28 (D12)	Chap. 18	2320
Lab 4: Dissolved Oxygen	Oct. 28 (D11) Nov. 4 (D12)	Nov. 4 (D11) Nov. 18 (D12)	Chap. 22	4500
Lab 5: Chemical Oxygen Demand and Total Organic Carbon	Nov. 18 (D11) Nov. 25 (D12)	Nov. 25 (D11) Dec. 2 (D12)	Chap. 24	5310, 5220

***There is no report for this lab. You must prepare notes in your lab book and complete the WHMIS training prior to entering the lab for Lab 2. There will also be a quiz on Lab 1 at the beginning of the lab session for Lab 2.*