Welcome to CHEMISTRY 4472B/9472B - 2022-2023 "ADVANCED ANALYTICAL CHEMISTRY"

~ COURSE OUTLINE ~

Notice from the Registrar: Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites (chemistry 3372B or the former chemistry 362B, 322). 4472 and 9472 are crosslisting and antirequisite courses for graduate students. For simplicity, Chem 4472B is used as the course name in this course outline.

Description: This joint undergraduate and graduate course encompasses selected topics at the advanced level of analytical sciences. They include simulations for electroanalytical chemistry, analytical instrumentation and their applications to research, computer titrations, advanced electrochemistry for analysis.

Instructor: ***Dr. Zhifeng Ding,*** **Professor of Chemistry**

Office: MSA 0203
E-mail: zfding@uwo.ca

Please use your Western email address to communicate with the instructor.

Lectures:

(1) *Monday*	11:30 - 12:20 p.m.	CHB 09
(2) *Wednesday*	11:30 - 12:20 p.m.	CHB 09
(3) *Friday*	11:30 - 12:20 p.m.	CHB 09

IMPORTANT DATES	
First Lecture in the winter semester	Monday, 9th January, 2023 – 11:30 am in CHB 09
Last Winter Lecture -	Earlier than Monday, 10th April, 2023

In-class labs: There are plenty in-class labs with software: LabVIEW, COMSOL and Excel.
(Please be prompt and bring your laptop for all classes).

Office hours: By appointment (via Zoom).

Chem 4472: OWL. Go to http://owl.uwo.ca/ and log in using your UWO user name and password. Check this website on a regular basis for updates and important information on the lectures, labs, tutorials.

Required materials: In-class handout and OWL PDF materials. Several reference textbooks might be reserved in Taylor Library. Please bring a laptop in class. No textbook is required. We only have the teaching license for LabVIEW, COMSOL. **By taking this course, we have your consent to use the software only for this course**, **NOT for any other purposes.**

Mobile Device or iClicker:

- Audience response systems ("clickers") will be used to provide immediate feedback on your understanding of course concepts. You will require a web - enabled device (phone, laptop, etc.) or an iClicker (not recommended). Participation marks are awarded for the use of "clickers". You must use your own "clicker" account and may not submit responses for any other student. The data collected using the devices will not be used for research purposes without your consent.

Course evaluation: There will be one midterm exam (see below for date). The midterm exam will be weighted 25 % each. There will be 6 assignments, each of which is 6% worth. There will be a presentation (15 minutes, see the detail in the specific section of this outline), which is weighted 35 %. "Clickers" participation will be counted 4%.

Tests and exam schedule		
Midterm (Open Book) Materials: computer titrations	(25%)	6:30 pm-8:30 pm, Wednesday, 22nd March, 2023 Location ChB 115 - make sure you check here: .....
6 assignments	(36%)	Will be announced in class
Clickers	(4%)	In-class clickers
Project presentation (11:30-5:30 pm) check here:	(35%)	11:30 am-5:30 pm Friday, Feb 17, 2023; Location ChB 09 - make sure you

"Clickers"	Marked on participation only. The score you receive will be based on the percentage of questions answered: 80% or more = 4; 70–79% = 3; 60–69% = 2; 40–59% = 1; Less than 40% = 0 There is NO makeup for iClicker questions

★★ THERE ARE NO MAKE-UPS FOR in-class LABS★★

- Exam are short answer questions.

Conditions required to pass the course: The assignments and midterm exam are essential components of the course. You must submit at least 4 of the 6 assignments, finish and present your project in a group, and write the midterm test. Students who fail to meet any of these requirements without academic accommodation for the missed work will receive a course grade of not greater than 40%, even if the calculated grade is higher. A student who is unable to submit the required minimum number of assignments for medical or compassionate reasons, and who wishes to complete the missed work, will need to apply for Incomplete Standing (a grade of INC) by submitting a written request to the Dean of the Faculty of Registration. If Incomplete Standing is granted, the student will be able to complete the missed items the

next time the course is offered. A student who is unable to write the midterm must apply for permission to write a makeup that will be one week after the midterm.

Learning outcomes

1. Knowledge of analytical instrumentation
2. Analytical simulation fundamentals
3. Computer titration essentials
4. Modern electroanalytical chemistry
5. Applications of modern analytical chemistry

Policies

Student absences and missed work. Students who are unable to meet their academic responsibilities due to medical or compassionate reasons may submit a request for academic consideration. For each missed piece of work **worth 10% or more** of the total course grade, you must apply for such consideration by providing valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration. For each missed or late assignment (a piece of work **worth less than 10%** of the total course grade), you do not need to provide medical documentation or contact the Academic Counselling Office, but you must send a written explanation of your absence to the instructor to be excused. Note that *all* accommodations for missed work, regardless of who grants them, are subject to the *Conditions required to pass the course*.

Accommodation for students with disabilities. Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. In cases where a student misses a piece of work for reasons related to the disability on file with Accessible Education, the student should request accommodation by contacting Accessible Education instead of the Academic Counselling Office.

Missed assignments. There are no make-up assignments. If you miss an assignment and are granted accommodation, the weight of the missed assignment will be transferred to the other ones.

Missed midterm test. If you miss a midterm test and are granted accommodation, a make-up test will be offered. If you miss the make-up midterm test and are excused as well, apply for Incomplete Standing (a grade of INC).

Late assignments. All assignments and lab reports must be submitted by the due date. Late submissions will be accepted for 24 hours after the due date without penalty, but will be rejected afterwards. Students who miss the automatically extended deadline and ask the instructor for accommodation will be excused. Students with applicable accommodations recommended by Accessible
Education can request a longer one-time deadline extension. To preserve the integrity of evaluation, this extension cannot exceed 7 days after the regular due date because graded assignments will normally be returned by that time. Students with disability accommodations who ask for a longer extension will be excused instead, subject to the *Conditions required to pass the course*.

Use of electronic devices. Only basic scientific calculators are permitted on all tests and exams. All other electronic devices (cell phones, laptops, tablets, cameras, etc.) are prohibited.

Scholastic offences. The University will take all appropriate measures to promote academic integrity and deal appropriately with scholastic offences. For definitions of what constitutes a scholastic offence, see *http://www.uwo.ca/univsec/pdf/academic policies/appeals/scholastic discipline undergrad.pdf*

Support Services. Detailed information on academic considerations for absences, religious accommodation, exam conflicts, appeals, and other academic matters may be found on the Science & Basic Medical Sciences Academic Counselling webpage: *https://www.uwo.ca/sci/counselling*. Students who are in emotional/mental distress should refer to Mental Health@Western (*https://uwo.ca/health*) for help.

Chem 4472B Presentation

1. Lectures continue till Monday, April 10, 2023 in CHB 09 or earlier.

2**. The presentation will be on Friday, Feb 17th 11:30 -5:30 pm in room TBA. Everyone has to be there all the time; otherwise a penalty will be applied.** In the event of illness or emergency, usual procedures will apply.

3. The presentation will be 12 min (maximum) for each student and 3 min questions follow. The presentation event will be from 11:30 am-6:30 pm on Friday, February 17, 2023 in room TBA. The duration depends on the number of students. Coffee and treats might be provided by the department.

4. At the end of the presentation event, please return the NI USB 6008 device, the voltmeter and the tool. Otherwise, your presentation marks will not be released.

5. Choose a topic on instrumentation based on LabVIEW or on simulation based on COMSOL. You are encouraged to select a project which is related to your 4491E or graduate thesis.

The scientific level should be equivalent to chem 3372b poster, less high than your 4491 project or chem 9658 seminar for graduate student, but higher than 4472 assignments. Please come to Dr. Ding's office to discuss your choice if needed.

For LabVIEW topic, please study the CV6008.vi I have emailed you. Basically the VI uses one of the two sub VIs I showed in class (4472ai.vi) to do data acquisition (recording the electrochem current and potential, we call it as passive usage of the AD/DA converter). Note that the device number may change with your USB device (NI 6008) and your computer. It will be a bonus if you can use the AD/DA converter to drive a device using 4472ao.vi. For example, switch on your light source or high voltage and

then switch off, integrate the detection signals within certain time, sweep a potential etc. You should have data acquisition, data analysis and data presentation in your VI you are going to make.

Sure, you can do a simulation project with COMSOL. For instance, as we explained in the class, you can simulate a cyclic voltammogram for a species which can be reduced and oxidized. You can also simulate a voltammogram for a species which has an electrochemical reaction at the electrode and then the reduced species or the oxidized species can go for a chemical reaction (EC mechanism).

The project you are going to do is by no means limited to the examples describe above.

Highlights of the presentation

Title and outline of your talk

INTRODUCTION describes the background to the instrument or simulation.

MATERIALS & METHODS what you prepared; what instrument you used; what you did. Might include a schematic diagram and/or photo of the instrument.
Or, what is your model of simulation.

RESULTS of your measurement or simulation

DISCUSSION can be the analyzed results

● DISCUSSION OF a RESEARCH PAPER or BOOK FROM THE LITERATURE, or the present situation/problems...Summarize what was done, may be include a diagram of best results.

● REFERENCES here must be a list (short) or key references -books -research papers that you used -best to use numbers (1) etc. in the text

● ACKNOWLEDGEMENTS who helped -who you wish to thank -financial support

●It is required to present a paper and it is a good idea to select a paper with topic related to your 4491 project or graduate thesis. It will make your presentation more focused and coherent.)

You must decide on your choice of the title by Friday, February 10, 2023 and e-mail to zfding@uwo.ca.

CHEMISTRY 4472B
PRELIMINARY LECTURE SEQUENCE 2022-2023
By Dr. Zhifeng Ding

Chemistry 4472B ***approximate number of lectures:***

1. Introduction **1 lecture**
- Operation of the course
- The first experiments:
- Check your computer and software installation
- Electronic Mail
- Midterm Exams, the Final Exam-presentation.

2. Simulations for Electroanalytical chemistry **7 lectures**
- Introduction to COMSOL software.
-Cyclic Voltammetry.

3. Analytical Instrumentation **7 lectures**
- Introduction to LabVIEW.
- Data acquisition.
- Instrument Control.
- Data Analysis

4. Presentation **11:30-5:30 on Friday, Feb 17, 2023**

5. Computer Titrations **8 lectures**
-Aqueous Solutions and Chemical Equilibria.
- Titrimetric Methods; Precipitation Titrimetry.
- Neutralization Titrations.
- Complexation Reactions and Titrations.

6. Electroanalytical Chemistry **6 lectures**
- Introduction to Electrochemistry.
- Applications of Standard Electrode Potentials.
- Applications of Oxidation/Reduction Titrations.
- Potentiometry.
- Voltammetry.