

**Course Outline**  
**Analytical Chemistry II: Instrumental Analysis**  
**CHEM\*3430 Summer 2019**

**Lecturer:** Rick deLaat (SSC 2506) **Email:** rdelaat@uoguelph.ca  
**Lectures:** Tues, Thur 10:00AM - 11:20AM MCKN, Room 315  
**Office Hours:** to be determined in class

**Lab Supervisor:** Dr. Kate Stuttaford (SSC 3113A) **Email:** kstuttaf@uoguelph.ca  
**Lab:** SSC Room 3105  
**Lab Teaching Assistant:** Allyson Yee

**Undergraduate Calendar Description:**

**CHEM\*3430 Analytical Chemistry II: Instrumental Analysis S,W (3-3) [0.50]**

This course examines methods for the separation, identification and quantification of substances in the solid, liquid and vapour states. Emphasis will be placed on modern instrumental methods and trace analysis.

Prerequisite(s): (CHEM\*2400 or CHEM\*2480)  
Restriction(s): TOX\*3300  
Department(s): Department of Chemistry

**Course Materials:**

**1. Strongly Recommended - you should have this from Analytical Chemistry I**

Textbook: Quantitative Chemical Analysis by Daniel C. Harris - 9<sup>th</sup> Edition, 2016

**2. Required**

Lab Manual for CHEM 3430 - available from the Chemistry Department Lab Manual Sales (Lab manual sales will begin May 13th). The lab manuals are available as a cash only purchase.  
Safety Goggles and Lab Coat.  
Scientific Calculator.

**Laboratory:**

Introductory labs are the week of May 13th. For the introductory lab, you should bring your lab manual only; you do not need lab coats or goggles. Attendance to the introductory lab is required and you can expect to stay for approximately one hour. During this time you will meet the TA, review lab safety procedures, be assigned a lab partner, and get the schedule of experiments so you know which experiment to prepare for the following week.

Your TA will set office hours to meet with students and to answer lab related question. It is best if you contact your TA or the lab coordinator about lab questions as they have a much greater knowledge of what is expected in the lab part of the course.

Course Web Site:

Course and lab materials will be available through <http://www.uoguelph.ca/courselink/> under CHEM\*3430 (01.01) S19 - Analytical Chemistry II website (there is only one courselink site for both lab and lecture materials). Use your university email **id** and **password** to access courselink.

**Course Evaluation:**

<b>LABORATORY</b>	<b>40%</b>
<b>PRESENTATION</b>	<b>10% (details on the CourseLink site)</b>
<b>MIDTERM</b>	<b>20%</b>
<b>FINAL EXAM</b>	<b>30%</b>

Midterm: Date to be decided with input from the class - it will be in Week 5, 6, or 7.

Final Exam: Wed August 14 08:30AM - 10:30AM (2019/08/14)

"Students must pass the Lecture component on its own AND the Laboratory component on its own to pass the course as a whole (i.e. students need to achieve an overall grade of at least 30/60 for the Midterm and the Final Exam AND a minimum of 20/40 for the Laboratory). This means that a high laboratory mark cannot be used to secure a pass if the lecture component is failed or vice versa. In cases where this standard is not achieved, the final grades assigned will either be the calculated grade or 49%, whichever is less."

**At the end of semester, all electronic copies of lab reports will be checked against each other and any archived reports from previous semesters using Turnitin. If unexpected similarities are found between two or more papers, both/all these submissions will be reviewed by the lab coordinator. After this review, if academic misconduct is suspected, the papers will be turned over to the Chair of the Chemistry Department for academic review.**

**In Class Discussions:**

Participation in classroom discussions and interacting with your class colleagues is an important aspect to successful learning. If you really want to learn and succeed in this class, you will want to participate in the questions posed by your lecturer during the class and to ask your own questions. To be best prepared to participate you should read the appropriate sections of the textbook and be prepared to discuss them. See the Reading List on the CourseLink website.

**Missed Midterm:**

A grade of zero will be assigned for a missed midterm except for valid medical or compassionate reasons. If you are excused for missing the midterm then the final exam will be worth 60% of the course. There will be no alternate midterm.

**Equal Opportunity and Evaluation Policy:**

The University is committed to academic integrity and has high ethical and moral standards. All students will be treated equally and evaluated using the criteria presented in this outline. Evaluation criteria are based strictly on achievement and not effort. There is no

extra work for extra credit or to “make up” a grade. The need to obtain a higher grade for various reasons is not grounds for increasing your grade. If your grade were to be “bumped” (i.e. gave you a grade that you did not legitimately earn), it would be unfair to all the other students in the course.

## **COURSE CONTENT (see the reading list on the courselink website for more details)**

### **Introduction:**

Goals of the course. The process of chemical analysis. Instrumental analytical methods versus classical analytical methods. Selectivity and interferences in trace analysis. Figures of merit in instrumental analysis (Accuracy, Precision, Sensitivity, Dynamic Range, Detection Limits, Selectivity). Calibration methods.

### **Spectroscopic Methods:**

Properties of electromagnetic radiation. Atomic Absorption Spectroscopy (Beer's Law, Instrumental components [light sources, monochromators, detectors]. Atomic Emission Spectroscopy. Flames. Inductively coupled plasmas (ICP). Detector arrays. Comparison of Atomic Absorption and Emission techniques.

### **Mass spectrometry**

Introduction to mass spectrometry. Ionization methods in atomic and molecular mass spectrometry. Mass spectrometry instrumentation. Applications of gas chromatography-mass spectrometry and liquid chromatography-mass spectrometry.

### **Separation Methods:**

The principles of chromatography. Partition coefficients (retention of analytes). Plate theory-van Deemter curves (efficiency of separation). Gas Chromatography (instrumental components and applications). Instrumental components and applications of Liquid Chromatography (normal phase LC, reversed phase LC, ion exchange LC, size exclusion LC). Capillary Electrophoresis.

### **Electroanalytical Methods:**

A brief review of electrochemistry. Potentiometric methods. Reference electrodes. Ion selective electrodes. Voltammetry and Polarography.

### **CHEM\*3430 Learning Outcomes**

On successful completion of this course, students should be able to:

1. Demonstrate knowledge and understanding of the basic chemistry principles behind spectroscopy, mass spectroscopy, chromatography, and electrochemistry.
2. List and describe the function of the instrument components in analytical spectroscopy, mass spectroscopy, chromatography, and electrochemistry instruments.

3. Determine which type of instrument is best for various types of analysis.
4. Understand the need for various types of calibration (calibration curves, internal standard, standard addition), be able to determine when to use each type, and be able to construct and use calibration curves.
5. Perform laboratory experiments demonstrating safe and proper use of the various analytical chemistry instruments including sample preparation, and use of the instruments.
6. Evaluate the results of an chemical instrumental analysis and write an appropriate lab report through working co-operatively with others or independently.

### **CHEM\*3430 Skills**

Through the content and concepts presented and the problems discussed, another purpose of this course is to help you further develop skills that will aid you in your future courses within your program and major as well as beyond. These skills are:

ability to think critically & apply knowledge to new problems (i.e., problem solving skills)

inquiry ([www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e396.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e396.shtml))

observing and the ability to design a simple experiment

work co-operatively with others and independently

depth and breadth of understanding as well as the capacity to know when you do not understand

([www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e403.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e403.shtml))

love of learning

([www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e427.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e427.shtml))

## **UNIVERSITY POLICIES**

### **E-mail Communication**

As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

### **When You Cannot Meet a Course Requirement**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in

writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration.

### **Drop Date**

Courses that are one semester long must be dropped by the end of the fortieth class day (**JULY 5<sup>th</sup> 2019**); two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

### **Copies of out-of-class assignments**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **Accessibility**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

### **Academic Misconduct**

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who

are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

### **Recording of Materials**

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### **Resources**

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.