1. Course Information

Course name: Chemistry 3372G Instrumental Analytical Chemistry
Lecture: Asynchronous Online (via OWL)
Laboratory: Mixed-mode (Accept enrollment as either in-person OR remote)
            In-person: Tuesday/Wednesday/Thursday, 1:30 – 5:20 pm (ChB 094)
            Remote: Online via OWL & Stream

First week of the lectures: January 11, 2021
First week of the labs: January 18, 2021

2. Contact Information

Instructor:

Dr. Lijia Liu
Office: ChB 066
Email: lijia.liu@uwo.ca

Lab Coordinator
Dr. Chris Levy
ChB 117
clevy9@uwo.ca

Lab Technician
Robert Harbottle
ChB 089

Lab Technician
Claire Tully
Martin Badley

Teaching Assistants
Jonathan Adsetts
Lindsay Grandy
Thao Do
Hunter Feltham
Elham Alaei

For your own protection, students must use only their @uwo.ca email account for all inquiries related to this course. All emails coming from non-UWO servers will be ignored.

3. Requisite

The prerequisite for Chemistry 3372G is Chemistry 2272F.

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may 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.

4. Accessibility

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education (formerly Services for Students with Disabilities) at 661-2147 or http://www.sdc.uwo.ca/ssd/ if you have questions regarding accommodation.

5. Course website

The lecture component of the course will be conducted fully remotely on Western’s OWL system (http://owl.uwo.ca). This is the primary learning platform on which information will be distributed to all students in the course. Lectures will be delivered asynchronously, by posted lecture notes and short videos on OWL. Discussions, self-assessment quizzes, assignments, and all course-related evaluations will be conducted on OWL as well.

The lab component of the course runs on a separate OWL course site. Lab manuals and lab-specific learning materials will be will be available on OWL. For the students who choose to do virtual labs (remote learning), all the learning activities are conducted on this OWL site and videos will be available on Stream.

6. Learning Outcomes

By the end of this course, student will be able to:

• gain an in-depth knowledge of the functionality of modern instrumentation that is at the heart of chemical-analytical methods.
• Understand the physical basis of chromatography-based separation techniques, such as gas chromatography and liquid chromatography, and understand how the instruments perform these tasks.
• understand the physical basis of mass spectrometry and then understand how the instruments perform these tasks.
• gain knowledge on several modern morphological characterization techniques for examining microscale object
• realize the important of surface analysis and the difference between surface and bulk chemistry structure
• provide preliminary assessment on the choice of analytical techniques upon given an analytical task
• become aware of the fundamental importance of integrity and ethics in analytical chemistry.
By a combination of classroom learning reinforced with hands-on experiential learning using modern instrumentation in the laboratory and preparation of professional analytical reports students will become well equipped for technical employment in a commercial or industrial analytical laboratory.

7. Course materials

Official Textbook
The following textbook is recommended, which is available at Western Bookstore.

Principles of Instrumental Analysis, 7th Ed.
Skoog, Holler, and Crouch
Cengage Learning

Previous versions are also acceptable.

Learning materials
Lecture videos, lecture notes, reading materials, and other learning resources will be posted on OWL.
Learning content will be posted weekly (usually on Monday). The amount is equivalent of a three-hour lecture.

Lab Manual:
The lab manual is available as an electronic document through the lab site on OWL (not the lecture site). It is mandatory that you view/download the lab manual prior to the labs.

Additional lab-related learning materials (for remote access)
Tutorial videos and other learning resources will be posted on OWL and Stream (the lab site).

Computer Software:
- Microsoft Excel for data analysis
- MATLAB (version 2019 or higher) for running the simulation program (absolutely required for BOTH in-person labs and remote labs): Western provides site license for downloading and activating MATLAB 2020a (https://wts.uwo.ca/sitelist/license/matlab/index.html).

8. Anticipated course topics
The following chapters are intended to be covered (subject to minor revision) in this course. The chapter numbers are based on the textbook by Skoog et al.
Chromatographic Separations (Chapters 26-30)
- Introduction to analytical separations
- Gas Chromatography
- Liquid chromatography
- Other separation techniques

High vacuum technology

Mass spectrometry (Chapters 11, 20)
- Introduction of mass spectrometry
- Mass spectrometry for element speciation (ICP-MS)
- Mass spectrometry for structure determination

Surface analysis techniques (Chapter 21, Peer-teaching)
- X-ray photoelectron spectroscopy
- Secondary ion spectroscopy
- Scanning electron microscopy
- Scanning probe microscopy

9. Methods of Evaluation
Students are evaluated based on their performances both in lab and in lecture. To pass the course, you must achieve a grade greater than 50% in BOTH (i.e. 50% or greater of the lab component, and 50% or greater of the lecture component).

Summary of components and weights

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Weight (missed mid-term)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab reports</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>Analysis of unknown</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Driver’s test</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Laboratory total</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Lecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer-Teaching</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-term test</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>Final exam</td>
<td>30%</td>
<td>45%</td>
</tr>
<tr>
<td>Lecture Total</td>
<td>65%</td>
<td>65%</td>
</tr>
</tbody>
</table>

- Laboratory (35%)

Due to the uncertainty of the COVID situation, the in-person labs schedule might subject to revision. Please pay attention to the course announcement.
The following instructions apply to BOTH in-person and remote lab sessions.

You will need submit all the required lab reports (no matter you are doing in-person or remote) to earn your mark for the corresponding components.

***Laboratory reports are to be submitted electronically via LAB SECTION OWL site using Turnitin.***

Submit lab report as MS Word (.doc, .docx) or Portable Document Format (.pdf) file. You are also required to submit the files that were used when completing the lab report as supporting documents, i.e. the Excel (.xlsx) file and, if applicable, the raw chromatogram data (.pdf).

The Driver’s test will be conducted as a one-on-one zoom meeting. Each student will meet with a TA at a pre-scheduled time for a short online interview. Students will be evaluated based on their knowledge on the instrumental analysis experiments they have performed in lab. The Driver’s test is mandatory. Failed to show up at your scheduled Driver’s test will result a fail in the lab component. Detailed instruction will appear as a separate document.

The laboratory component of this course is of particular importance. Performance in your lab work will be monitored closely by the teaching assistants, instructor, and laboratory coordinator. Students must pass the laboratory component (reports, analyses of unknowns, the driver's test, combined score greater than 50% of the lab component) in order to pass the course.

For in-person labs only:
In mid-February, (well before the drop deadline for the course on March 7th 2020), you will receive an interim progress notation on your laboratory competency (related only to your experimental techniques and the safe operation of equipment. Your lab reports are not considered as part of this evaluation). You will receive one of the following evaluations:

Satisfactory: you are performing your experiments in a safe and appropriate manner

Caution: you have some serious defects in your lab performance and you are in danger of not performing to your best potential. Some of your actions may potentially damage equipment or impede the performance of your lab partner. Remedial action is required, and you should discuss this matter with your teaching assistant.

Unsatisfactory: Your lab performance is very poor. You will be asked to meet with the instructor to discuss ways to improve the situation.
Students whose performance in the laboratory is consistently unsafe or destructive, in the opinion of the instructor, will be removed from the laboratory for the remainder of the lab session and reported to the Associate Chair of Chemistry. A zero mark will be assigned to the corresponding lab report. Continued unsafe or destructive performance will, on recommendation of the Department, and with the permission of the Dean of the Faculty, result in the student being excluded from further laboratory sessions in the course and the student will not be entitled to further evaluation in the course.

- **Lecture (65%)**
- **Peer-teaching (20%)**

You will form a learning group of eight students. In your group, you will participate in BOTH teaching and learning activities, and you will be evaluated based on your teaching performance (as a teacher) and learning outcome (as a learner). Each learning group (main group) is then evenly divided into four subgroups. Each subgroup is responsible for teaching one topic to the rest of the member in the main group, and attend lessons given by the other members in the main group.

Peer teaching is conducted **online synchronously**, but you are free to choose any time/date as long as it works for all members in the group. The teaching can be divided into multiple sessions, but the entire teaching/learning activity shall be completed within two weeks (in late-March).

- **As a teacher, you will:**
  1. Work with your partner, develop a 30 min-long lesson, on one of the following analysis techniques:
     - X-ray photospectroscopy (XPS)
     - Secondary Ion Mass Spectroscopy (SIMS)
     - Scanning electron microscopy (SEM)
     - Scanning probe microscopy (SPM)
   
   No duplicate topics are allowed within one group. For example, if XPS is already chosen by a subgroup, the rest three subgroups cannot choose XPS any more.

  2. Prepare lecture material and design a quiz containing FIVE multiple choice questions to evaluate your learners’ learning outcome. The Zoom online survey is a good way to achieve this purpose. You will collect your learners’ response and provide them your feedback.

  3. Make sure you check the attendance of your lesson, record the entire live zoom session. (Only audio is fine.)

- **As a learner, you will:**
  1. Attend, as an independent learner (not with your teaching partner), all three
lessons taught by members in your group.
(2) Participate in-class quizzes.
(2) Provide your feedback on your peers’ teaching performance using rubrics provided.

You will be evaluated both as a teacher and a learner. The detailed mark breakdown, evaluation rubrics, progressing timelines, and required documents to submit can be found in a separate document on OWL.

**Mid-term Test (15%)**
Mid-term test will be scheduled during the last week before the reading week (Tentatively February 13). The test will be performed in a remotely proctored, synchronous online mode. The format of this test will be multiple choice and short answer responses. The test is expected to take no more than 60 min to finish, but extra time will be given to provide buffer time to deal with unforeseen technical issues.

**Final Exam (30%)**
Date/Time scheduled by Office of Registrar. The test will be conducted in a remotely proctored, synchronous online mode. The Final Exam will be cumulative, but more weight is placed on the content taught after the mid-term. The format of the final exam will be a mixture of multiple choice and short answer questions.

10. Course policies

**Plagiarism and cheating are major academic offences.** Tests, exams, and lab reports may be checked with software that searches for unusual coincidences in answer patterns and/or copying that may indicate cheating. Do not copy information from old lab reports. Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: 

All lab reports will be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com ).
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following website:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean’s office as soon as possible and contact your instructor immediately. See -
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

It is the student’s responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. There is no make-up session possible for missed laboratory experiments; in this case the grades for the reports will be re-weighted within the laboratory envelope. In the event of a missed midterm test, the weight of the midterm may be applied to the final exam, at the discretion of the instructor. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean’s Office immediately. For further information please see:
https://www.uwo.ca/sci/counselling/procedures/special_examination.html

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean’s Office) for visits to Student Health Services. The form can be found here:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

Other Accommodations and Services

Link to the policy on Accommodation for Students with Disabilities
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf

Link to the policy on Accommodation for Religious Holidays
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Link to services provided by the University Students’ Council:
http://westernusc.ca/services/
Laboratory Safety

Students must seek approval from TAs whenever they leave the laboratory during experiments. They must return within a reasonably short period. Students leaving without approval will not be allowed to return to the lab, and will receive 0% on their lab mark.

This course is supported by the Science Student Donation Fund.

If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students’ Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing paperwork in the Faculty of Science Dean’s Office. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the chair of your department or email the Science Students’ Council: ssc@uwo.ca.