



Advanced Analytical Chemistry
The University of Toledo
Department of Chemistry and Biochemistry, College of Natural Sciences and
Mathematics
(CHEM 3360)-CRN: 18433

Instructor: Prof. Ajith Karunaratne	Office Hours: T&W-> 2-3 PM
Email: ajith.karunaratne@utoledo.edu	Office Location: BO 2098
Office Phone: 419-530-7880	Class Location: Bowman-Oddy 2087
Term: Spring, 2022	Class Day/Time for 001, 091 M&W→1.00-3.50PM
	Class Day/Time for 003, 093 M&W→5.30-8.20PM
	Class Day/Time for 002, 092 T&R→ 1.00-3.50PM

Credit Hours: 2

COURSE/CATALOG DESCRIPTION

This laboratory teaches some practical analytical methods for the quantitative determination of an analyte.

2.000 Credit hours,

Levels: Undergraduate

Schedule Types: laboratory

COURSE OVERVIEW

The class consists of a range of 'wet chemistry' techniques, which include acid-base, precipitation, complexometric and redox titrations, chromatographic and spectrophotometric analysis. A special emphasis will be given on sample preparation, dealing with interferences, method optimization, data analysis, validation, and statistical treatment of data. This laboratory also has a strong focus on proper recording data in a laboratory notebook as well as reporting and interpretation of the data.

STUDENT LEARNING OUTCOMES

At the end of the course, students are expected to have hands-on skills in basic experimental methods and associated theoretical understanding in analytical chemistry. Students also should be able to perform analysis of data, statistical testing of results, and compile a full lab report following the sample lab report formatted following the article format of ACS journal "Analytical Chemistry". Students are expected to include information from their literature survey, experimental methods, observations and results and a conclusion in this Writing Across the Curriculum (WAC)-lab report. The goal is to provide the ability to independently conduct an investigation and report the findings in an industrial or academic setting.

PREREQUISITES AND COREQUISITES

CHEM 3310 or equivalent.

REQUIRED TEXTS AND ANCILLARY MATERIALS

Laboratory handbook is available on the blackboard. Additional reading material will be provided as needed.

- Laboratory Manual (check the blackboard)
- Laboratory Notebook (bound, duplicate sheet style)

- Laboratory safety goggles (full coverage)
- Labcoat as needed
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Recommended Textbooks:

1. D. A. Skoog, S. R. Crouch, F. J. Holler, Fundamentals of Analytical Chemistry, 9th edition, Cengage Learning; 9 edition (January 1, 2013) ISBN-13: 978-0495558286
2. D. C. Harris, Quantitative Chemical Analysis, 9th Edition, W. H. Freeman Company, 2006. ISBN: 0716770415
3. D. A. Skoog, S. R. Crouch, F. J. Holler, Principles of Instrumental Analysis, 6th Edition, Brooks/Cole, 2006. ISBN: 0495012017
4. E. de Hoffmann, V. Stroobant, Mass Spectrometry: Principles and Applications, John Wiley & Sons, 2002. ISBN: 0471485667.
5. F. W. McLafferty, Interpretation of Mass Spectra, 4th Edition, University Science Books, 1993. ISBN 0-935702-25-3.
6. J. B. Lambert, H. F. Shurvell, D. A. Lightner, and R. G. Cooks Organic Structural Spectroscopy, Prentice Hall, 1998 (reprinted in 2001). ISBN 0-13-258690-8.
7. Douglas B. Murphy, Michael W. Davidson Fundamentals of Light Microscopy and Electronic Imaging, Second Edition, Wiley-Blackwell, August 22, 2012, Print ISBN: 9780471692140, Online ISBN: 9781118382905

Note that proper clothing and footwear are required to ensure safety while in the laboratory. Students not properly dressed will not be allowed into the laboratory! Legs, arms, shoulders, and feet should be covered all the time in the laboratory.

- Full-length Pants (Should cover the lower limbs,
- Flat closed-toe footwear with full heel and sock,
- Eating, drinking, and the use of communication, entertainment devices are not allowed.

TECHNOLOGY REQUIREMENTS

Scientific calculators

UNIVERSITY POLICIES

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.](#)

Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course, please contact the <http://www.utoledo.edu/offices/student-disability-services>

HEALTH AND WELLNESS

Please follow the link

<https://www.utoledo.edu/coronavirus/faqs.html#:~:text=The%20University%20is%20following%20an,on%20campus%20for%20fall%20semester.>

to find extended information on the campus operations during COVID-19 pandemic.

What Can I Do To Protect Myself And Others?

The CDC recommends people take the same preventative actions they would for any respiratory disease.

- Avoid close contact with people who are sick or may have been exposed to the virus. Avoid touching your eyes, nose and mouth.
- Put distance between yourself and other people. Public health officials continue to recommended keeping a six-foot distance from others when possible.
- **Wear a cloth face covering or mask when in public, especially when social distancing is not possible.**
- Wash your hands often with soap and water for at least 20 seconds.
- If soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% alcohol.
- **Clean and disinfect frequently touched objects and surfaces using a regular household cleaning spray or wipe.**

There is currently no vaccine to protect against COVID-19, though researchers are working to develop one.

ACADEMIC POLICIES

Attendance:

There are NO MAKEUPS for this laboratory. If you have a valid excused absence (see university webpages for policy on what constituted a valid excuse) you will be allowed to participate in the remaining portion of the lab (the techniques are important) and if you are incapable of finishing the entire lab in that time, adjustment to your grade will be made. Unexcused absences will be handled similarly, but no leeway will be made. Excused absences have 24 hours to contact the instructor, TA, or Chemistry Department Main Office by email or phone. Documentation must be provided within seven (7) days of the missed class. Reports due but not handed on time because of absences will still be accepted for both excused and unexcused absences. Unexcused, though, will be docked up to 20 points unless turned in by someone else (classmate, roommate, etc.) at the appropriate time.

Academic Dishonesty:

You are urged to refer to the University's policy on Academic Dishonesty and the Student Code of Conduct, which can be found on the university's website. Violation of these policies can result in a grade of F for the subject laboratory report or even for the entire course. Please note that academic dishonesty in this course includes (but is not limited to) plagiarism of another's work (website, text, any part of a peer's lab report, etc.), falsification of data, etc.

Students Requiring Special Assistance:

Students requiring special assistance may identify themselves to the instructor at the beginning of the semester.

Special needs during exams: If a restroom break is required during an examination, during the break, you will not be allowed to access any study materials, carry backpacks with you, or use electronic media. The exam clock will continue countdown during the break.

COURSE EXPECTATIONS

Lab Notebooks:

All data must be entered directly into a bound notebook. Duplicate sheet style notebooks are preferred. Proper format for entry is included on page 6 of the lab manual. 8

Prelabs:

The prelabs are mandatory and designed to help guide your thinking about the experiments to be done. The prelabs are posted on blackboard. You will have to complete the prelab before you enter the laboratory.

Lab Reports:

Reports are due at the beginning of the next lab session following the completion of that lab. (Finish on Thursday, then labs are due on the following Tuesday.) Format of the lab report is described in the lab manual (Laboratory manual can be found on the blackboard. When revisions for the manual are made, you will be informed. These can be turned in on standard paper. Lab reports are expected to be typed and printed, with a photocopy or scanned attachment of your data. Your results and calculation sample should be marked. Graphical representation of data is preferred in a computerized format (using excel, origin).

Honors Students:

All Honors students will be assigned an additional project, whose successful completion will be required to receive Honors credit. A meeting will be scheduled with all enrolled Honors students during the first quarter of the semester to outline and discuss this project. A deadline for completion of this project will also be specified.

GRADING

The grading scale for exams and the final project is as follows:

90- 100% = A	86-89.9% = A-	82-85.9% = B+
78-81.9% = B	74-77.9% = B-	70-73.9% = C+
66-69.9% = C	62-65.9% = C-	58-61.9% = D+
54-57.9% = D	50-53.9% = D-	< 50% = F

- 100 points each

10 Laboratory Experiments (tentative)

1 Lab Practical

Total

- 200 points

- 1200 points

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 - If soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% alcohol.
 - **Clean and disinfect frequently touched objects and surfaces using a regular household cleaning spray or wipe.**
- There is currently no vaccine to protect against COVID-19, though researchers are working to develop one.

ACADEMIC POLICIES

Attendance:

You must notify me before the start of class by email or voicemail for an absence to be excused in accordance with the University Missed Class Policy. Texting, use of social media, or Skype or the use of mobile phones are not allowed in the classroom. Please arrive on time, as there would be no excuses for tardiness.

Covid-19 related absences: If you are tested positive for covid-19, please do not attend the class, and you should immediately inform Dr. Karunaratne at ajith.karunaratne@utoledo.edu. You should submit the test results too. If you are suspected of being exposed to Covid-19 infected, you should not attend the class and inform Dr. Karunaratne immediately. In this case, you will also have to submit the test results, whether positive or negative, to validate the absence, and you should do this as soon as the test results are available.

Once you inform Dr. Karunaratne about your condition, if you are quarantining and waiting for the test results, you will be provided with the data to write the complete lab report. You may have an additional assignment as well to compensate for missing the lab. If you are unwell with the COVID-19 infection with positive test results, the labs you missed will not be accounted for your final grade.

Academic Dishonesty:

The academic honesty policies, as stated in the 2013-2014 UT Catalogue, will be STRICTLY ENFORCED. Any student found violating the UT academic honesty policies will be penalized in accordance with these policies. You should read the university's policy on Academic Dishonesty found at http://www.utoledo.edu/catalog/2000catalog/admissions/academic_dishonesty.html. There is also an academic honesty policy posted on Blackboard.

ACADEMIC ACCOMMODATIONS

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](#) by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

Policy Statement on Non-Discrimination on the Basis of Disability (ADA)

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability – Americans with Disabilities Act Compliance](#).

TECHNOLOGY REQUIREMENTS, SKILLS, AND PRIVACY POLICIES

- Please view the [technology considerations](#) for this course, including technical skills needed, general technology requirements, and technology privacy policies.
- Any scientific calculator
- A laptop computer is recommended for classes that cover data analysis with Origin Pro

TECHNOLOGY REQUIREMENTS FOR ONLINE EXAMS (IF ANY)

LockDown Browser + Webcam Requirement

This course requires the use of LockDown Browser and may need a webcam for online exams. The webcam can be the type that's built into your computer or one that plugs in with a USB cable.

Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature.

<https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

Download Instructions

Download and install LockDown Browser from this link:

<https://download.respondus.com/lockdown/download.php?id=213815819>

GENERAL TECHNOLOGY REQUIREMENTS

Students need to have access to a properly functioning computer throughout the semester. The Browser Check Page <http://www.utoledo.edu/dl/helpdesk/browser-check.html> will enable you to perform a systems check on your browser and to ensure that your browser settings are compatible with Blackboard, the learning management system that hosts this course.

Software Student computers need to be capable of running the latest versions of plug-ins, recent software and have the necessary tools to be kept free of viruses and spyware. The computer needs to run the following software, available in the UT Online Download Center. • Word Processing Software • Adobe Acrobat Reader • Java Plugin Console • Adobe Flash Player • Adobe Shockwave Player • Google Chrome Browser – Recommended

Internet Service High-speed Internet access is recommended, as dial-up may be slow and limited in downloading information and completing online tests. This course does contain streaming audio and video content.

Use of Public Computers: If using a public library or other public access computer, please check to ensure that you will have access for the length of time required to complete tasks and tests. A list and schedule for on-campus computer labs is available on the Open Lab for Students webpage.

UT Virtual Labs: Traditionally, on-campus labs have offered students the use of computer hardware and software they might not otherwise have access to. With UT's Virtual Lab, students can now access virtual machines loaded with all of the software they need to be successful using nothing more than a broadband Internet connection and a web browser. The virtual lab is open 24/7 and 365 days a year at VLAB: The University of Toledo's Virtual Labs.

Learner Technical Support can be found here <http://www.utoledo.edu/dl/students/learnersupport.html>

ACCESSIBILITY OF COURSE TECHNOLOGIES

Please view [Accessibility of Course Technologies](#) for information regarding the accessibility of Blackboard and other technologies used in this course.

ACADEMIC AND SUPPORT SERVICES

Please view the [Learner Support](#) page for links and descriptions of the technical, academic, and student support services available to UT students.

SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

Point Distribution:

- **20% of your lab grade (20 points per experiment) will be based on the accuracy and precision of your analysis.** This class is about analysis and technique. Your grade will reflect your ability to accurately and reproducibly determine the amount of unknown. The following scale will be used to determine the accuracy and precision score based on the calculated error %:
To pass the course, you are required to have at least half of the total points assigned for accuracy and precision.
 - < 1% = 20 points; 1 – 2% = 18 points; 2 – 3% = 16 points; 3 – 4% = 14 points; 4 – 5% = 12 points; 5 – 6% = 10 points; 6 – 7% = 8 points; 7 – 8% = 6 points; 8 – 9% = 4 points; 9 – 10% = 2 points; > 10% = 0 points.
 - TAs will also consider the precision, representation, and interpretation of the data.
- **60% of your lab grade will be based on the quality of your lab write-up/report.** Guidelines for writing an effective laboratory report will be provided.
- **10% of your lab grade will be for answering prelab questions and Just in Time questions (JiTT),** which will be provided either by the instructor, the TA, on blackboard, or in the laboratory manual.
- **10% of your lab grade will be based on the care with which observations and data are recorded in your laboratory notebook.** Guidelines for data recording and keeping your laboratory notebook will be provided.

COMMUNICATION GUIDELINES

E-mail preferred

Room: BO 2047	E-mail: ajith.karunaratne@utoledo.edu
Office: BO 2098B	Tuesdays 2:00 – 3:00 p.m. Wednesday 2:00 – 3:00 p.m. or by appointment
TA-Section 001 and 0091 Jennifer -	The TA will inform you. Jennifer.Thornburg@rockets.utoledo.edu
TA-Section 002 and 092 Nithini, BO2090F	The TA will inform you. NithiniPrabhashwarie.RajakarunaMudiyanselagei@rockets.utoledo.edu
TA-Section 003 and 093 Koshala, BO 2098A	The TA will inform you. Koshala.Olupothage@rockets.utoledo.edu

COURSE SCHEDULE

A detailed course schedule will be posted on the blackboard.