Advanced Analytical Chemistry
The University of Toledo
Department of Chemistry and Biochemistry, College of Natural Sciences and Mathematics
(CHEM 4305, 6300, 8300) - CRNs: 61820, 45049, 45050

Instructor: Ajith Karunarathne
Office Hours: M→1-2 pm
Email: ajith.karunarathne@utoledo.edu
Office Phone: 419-530-7880
Office Location: BO 2098
Class Location: Bowman-Oddy 2059, Blackboard/remote
Term: Fall, 2020
Class Day/Time: TR→2:30 pm - 4:20 pm
Credit Hours: 4

CATALOG/COURSE DESCRIPTION
An overview of techniques in analytical chemistry. Topics include sample preparation and sampling, spectroscopic, separation, electrochemical, surface characterization, and thermal methods. Prerequisite: Permission of department.
4.000 Credit hours, 4.000 Lecture hours
Levels: Undergraduate/Graduate
Schedule Types: Lecture

COURSE OVERVIEW
The objective of this course is to review many of the principles and applications of selected analytical methods in chemistry, with the primary purpose of preparing graduate students for specialized courses and research in multidisciplinary areas. The focus will be placed on topics including the analytical process, types, and sources of error, calibration, Statistical treatment of data, microscopy and imaging approaches, mass spectrometry, spectroscopic methods, chromatography, as well as selected analytical techniques and applications that have garnered much interest in recent years. A particular emphasis will be given on sample acquisition, dealing with interferents, method optimization, data analysis, validation, and statistical treatment of data. You will require referring, discussing peer-reviewed scientific literature, and identify the strengths, and weaknesses employed analytical approaches.

EXPECTED STUDENT LEARNING OUTCOMES
• By the end of this course, you are not only expected to
• Apply knowledge about methodologies that would help you solve analytical chemistry problems in your research,
• Develop abilities to critically evaluate analytical problems and propose creative solutions
• Analyze your data and interpret your results by considering statistics
• Improve your analytical writing and presentation skills

PREREQUISITES AND COREQUISITES
Permission of department

REQUIRED TEXTS AND ANCILLARY MATERIALS
Materials for the course are drawn from multiple resources, including scientific literature. The following textbooks can be helpful for additional reading materials.
Recommended Textbooks:

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%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:
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.

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
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.

COURSE EXPECTATIONS
You are expected to take part in classroom discussions and demonstrations. Several modern teaching approaches, such as just in time teaching (JITT) and Peer-led Team Learning (PLTL), will also be employed. Unless otherwise instructed, the use of the internet and social media is strictly prohibited in the classroom.

GRADING
Three exams will be given. Please see the schedule at the end of this document for class schedule and the exam dates
Tentative exam dates:
• Each of these exams will count for 25% of your final grade.
• Homework problems will be regularly assigned and will account for 10% of your final grade.
• Research paper will carry 10% of the grade
• In class presentations will carry 10% of your final grade.

All exams will be based on the lecture notes, assigned problems, and assigned readings (textbook and journal articles). Participation in the class is strongly encouraged.

Letter grades
COMMUNICATION GUIDELINES
Email preferred

| Room: BO 2059 | Email: ajith.karunarathne@utoledo.edu |
| Office: BO 2098 | Office hours: MW 1-2 pm or by appointment |

COURSE SCHEDULE

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<thead>
<tr>
<th>Week</th>
<th>Tentative Topic</th>
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<tbody>
<tr>
<td>Aug. 18-20</td>
<td>The Analytical Process, Measurements, Error, and Calibration</td>
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<td>Aug. 25-27</td>
<td>Statistical Treatment of Data</td>
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<td>Sept. 1-3</td>
<td>Data Analysis-Using OriginPro</td>
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<td>Sept. 8-10</td>
<td>Data Analysis/ GLP</td>
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<td>Sept. 15</td>
<td>GLP</td>
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<td>Sept. 17</td>
<td><strong>Exam-1</strong></td>
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<td>Sept. 22-24</td>
<td>Introduction to Optical approaches and electronic imaging for bioanalysis</td>
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<td>Introduction to light microscopy</td>
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<td>Sept. 29</td>
<td>Photon detectors</td>
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<td>Oct. 1</td>
<td>Fluorescence</td>
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<td>Oct. 6-8</td>
<td>Optical sectioning and confocal imaging</td>
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<td>Oct. 13-15</td>
<td>FRET, BRET and FRAP</td>
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<td>Multiphoton approaches</td>
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<td>Oct. 20-22</td>
<td>Super-resolution approaches</td>
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<td>Image analysis</td>
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<td>Oct. 27</td>
<td><strong>Exam-2</strong></td>
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<td>Ct. 29</td>
<td>Introduction chromatography</td>
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<td>Nov. 3-5</td>
<td>Commonly used chromatography terms</td>
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<td>Types of chromatography and chromatographic instruments</td>
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<td>Nov. 10-12</td>
<td>Various chromatographic applications and instruments</td>
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<td>Nov. 17-19</td>
<td>Instrumental aspects of mass spectrometry</td>
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<td>Nov. 24</td>
<td>Summary discussion</td>
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<tr>
<td><strong>Finals week</strong></td>
<td>**** Final Exam ******</td>
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<td>Monday, 12/03, The time will be announced later</td>
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