



**SYLLABUS TEMPLATE
(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	Course Website:	Blackboard Learn (if applicable)
Email:	ajith.karunarathne@utoledo.edu	Class Location:	Bowman-Oddy 2059
Office Hours:	TR 4.30-5.30 PM	Class Day/Time:	TR→2:30 pm - 4:20 pm
Office Location:	BO2098	Credit Hours:	4
Instructor Phone:	530-7880		
Offered:	Fall 2021		

CATALOG/COURSE DESCRIPTION*

Schedule Types: Lecture

An overview of new 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

COURSE OVERVIEW/ TEACHING METHODOLOGY

The objective of this course is to examine the foundation of the principles and applications of selected analytical methods in chemistry, with the primary purpose of preparing graduate and undergraduate 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, optical-microscopy-imaging approaches, spectroscopic methods, and chromatography. We also review selected analytical techniques and applications that have garnered much interest in recent years as well. A particular emphasis will be given on sample acquisition, dealing with interferences, 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. The class meets face-to-face.

STUDENT LEARNING OUTCOMES

- By the end of this course, you are not only expected to
- Apply knowledge about methodologies that would help you solve problems related to chemical analyses 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

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:

1. **D. C. Harris, Quantitative Chemical Analysis, 9th Edition, W. H. Freeman Company, 2006. ISBN: 0716770415**
2. 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
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

TECHNOLOGY REQUIREMENTS

Some classes may require access to a personal computer.

ACADEMIC POLICIES

The University is an equal opportunity educational institution. Academic Policies for Undergraduate Students: All students at the University of Toledo are expected to read, understand, and follow the academic policies that govern their attendance at the University. These policies include, but are not limited to, academic dishonesty, academic forgiveness, adding and dropping a course, grades and grading, and the missed class policy. Please use the following URL to read a comprehensive list of academic policies that pertain to you in this class and throughout your academic journey: <http://www.utoledo.edu/policies/academic/undergraduate/>. If you have any questions after reading through the policies, please let me know.

Academic Policies for Graduate Students: All graduate students at the University of Toledo are expected to read, understand, and follow the academic policies that govern their attendance at the University. These policies include, but are not limited to, academic dishonesty, academic grievance, leave of absence, and transfer of credit. Please use the following URL to read a comprehensive list of academic policies that pertain to you in this class and throughout your graduate education at UToledo: <http://www.utoledo.edu/policies/academic/graduate/>. If you have any questions after reading through the policies, please let me know.

OVERVIEW OF COURSE GRADE ASSIGNMENT*

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, literature presentations, polling and other modes of tests will account for 25% of the final 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 mandatory.

Letter grades

90% < A	85-89% = A-	
80-84% = B+	75-79% = B	70-74% = B-
65-69% = C	60-64% = C-	55-59% = D+
50-54% = D	45-49% = D-	< 44% = F

UNIVERSITY POLICIES*

Institutional Classroom Attendance Policy Statement

Please be aware that the university has implemented an attendance policy, which requires faculty to verify student participation in every class a student is registered at the start of each new semester/course. If you have not attended/participated in class (completed any course activities or assignments) within this period, I am required by federal law to report you as having not attended class. This date varies by the part of term, in which your course started, these dates can be found here:

<https://www.utoledo.edu/offices/provost/mandatory-attendance-tracking.html>. Unfortunately, not attending/participating in class impacts your eligibility to receive financial aid, so it is VERY important that you attend class and complete course work early. Please contact me as soon as possible to discuss options and/or possible accommodations if you have any difficulty completing assignments.

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 Disability Act Compliance](#). Students can find this policy along with other university policies listed by audience on the [University Policy webpage](#) (<http://www.utoledo.edu/policies/audience.html/#students>).

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 the Office of Accessibility and Disability Resources, 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 accommodations with the Office of Accessibility and Disability Resources and are experiencing disability access barriers or are interested in a referral to health care resources for a potential disability, please connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.



ACADEMIC AND SUPPORT SERVICES*

Please follow this link to view a comprehensive list of [Student Academic and Support Services](http://www.utoledo.edu/studentaffairs/departments.html) (http://www.utoledo.edu/studentaffairs/departments.html) available to you as a student.

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.

INCLUSIVE CLASSROOM STATEMENT

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

COURSE SCHEDULE*

Week		Tentative Topic
Aug. 31 – Sept. 2	Understanding analytical process and optimizing the rigor of data analysis and interpretation.	The Analytical Process, Measurements, Error, Error propagation and Calibration
Sept. 7 - 9		Statistical Treatment of Data
Sept. 14 - 16		Data Analysis-Using OriginPro
Sept. 21 - 23		Data Analysis-Using OriginPro and Understanding your data
Sept. 28 Sept. 30		Understanding your data contd. Exam-1
Oct. 5 - 7	Optical and spectroscopy approaches in analysis.	Introduction to Optical approaches and electronic imaging for bioanalysis Introduction to light microscopy
Oct. 12 Oct. 14 → Fall Break		Photon detectors Fluorescence
Oct. 19 - 21		Optical sectioning and confocal imaging
Oct. 26 - 28		FRET, BRET and FRAP Multiphoton approaches
Nov. 2 - 4		Super-resolution approaches Image analysis
Nov. 9 Nov. 11 → Veterans day Nov. 16		Exam-2 Introduction chromatography
Nov. 18 – 23 Nov. 25 → Thanks G		Commonly used chromatography terms Types of chromatography and chromatographic instruments
Nov. 30 – Dec. 2		Various chromatographic applications and instruments
Dec. 7 - 9		Instrumental aspects of mass spectrometry, Summary discussion
Final Exam Dec. 14		***** Final Exam ***** Tuesday 2:45-4:45 p.m.