



**Course** CHEM 5355 001 Analytical Techniques I  
**Professor** Dr. Inga Holl Musselman  
**Term** Fall 2009  
**Meetings** TR 10:00 – 11:15 a.m., CBW 1.204

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### Professor's Contact Information

**Office Phone** (972) 883-2706  
**Office Location** Berkner Hall, BE 2.504  
**Email Address** [imusselm@utdallas.edu](mailto:imusselm@utdallas.edu)  
**Office Hours** Please come by my office or make an appointment.

### General Course Information

**Pre-requisites, Co-requisites, & other restrictions** None

**Course Description** Study of fundamental analytical techniques, including optical spectroscopic techniques, mass spectrometry, and microscopic and surface analysis methods.

#### Course Objectives:

The objective of this course is to introduce the graduate students to a range of analytical instrumental methods. The analytical techniques include qualitative optical spectroscopic methods (e.g. FTIR, ATR-FTIR, Raman spectroscopy, and powder X-ray diffraction), quantitative optical spectroscopic methods (e.g. AA, ICP-AES, ICP-MS, XRF, UV/Vis, Fluorescence Spectroscopy), mass spectrometry (e.g. EI-MS, CI-MS), and microscopic and surface analysis methods (e.g. STM, AFM, SEM, XPS).

### Learning Outcomes

#### Expected Learning Outcomes:

Upon successful completion of this course, students will therefore:

1. Be able to explain and apply the theory and instrumentation of instrumental analysis methods.
2. Be able to search the chemical literature and synthesize and evaluate information from that research.
3. Be able to prepare and deliver a scientific presentation.

**Required Texts & Materials** "Principles of Instrumental Analysis, 6<sup>th</sup> Edition", Skoog, Holler, Crouch, Brooks Cole

**Supplemental Texts, Readings, & Materials** The required text will be supplemented with monographs, reviews and/or research articles.

## Schedule & Academic Calendar

Date	Lecture Topic	Text Chapter
<b>INTRODUCTION</b>		
August 25	Introduction, Designing Measurements, Modular Approach to Instrumentation	1, 5-7
<b>QUALITATIVE OPTICAL SPECTROSCOPIC METHODS</b>		
August 27	Fourier Transform Infrared Spectroscopy	16, 17
September 1	Fourier Transform Infrared Spectroscopy	16, 17
September 3	ATR-FTIR, FTIR Microspectroscopy	17
September 8	Raman Spectroscopy	18
September 10	Raman Spectroscopy	18
September 15	Powder X-ray Diffraction	12
September 17	Powder X-ray Diffraction	12
September 22	<b>EXAM 1</b> (sample prep, figures of merit, signal-to-noise, infrared, Raman, XRD)	
<b>QUANTITATIVE OPTICAL SPECTROSCOPIC METHODS</b>		
September 24	Atomic Absorption Spectroscopy	8, 9
September 29	Atomic Absorption Spectroscopy	8, 9
October 1	Inductively Coupled Plasma Atomic Emission	10
October 6	Inductively Coupled Plasma Mass Spectrometry	11
October 8	X-ray Fluorescence Spectrometry	12
October 13	UV and Visible Molecular Absorption Spectrometry	13, 14
October 15	UV and Visible Molecular Absorption Spectrometry	13, 14
October 20	<b>EXAM 2</b> (FAAS, GFAAS, ICP-AES, ICP-MS, XRF)	
October 22	Molecular Fluorescence Spectrometry	15
<b>MASS SPECTROMETRY</b>		
October 27	Introduction to Vacuum Science and Mass Spectrometry	
October 29	Mass Spectrometry of Volatile Analytes: Ion Sources	20
November 3	Mass Spectrometry of Volatile Analytes: Mass Analyzers	20
<b>MICROSCOPIC AND SURFACE ANALYSIS METHODS</b>		
November 5	Scanning Tunneling Microscopy	21
November 10	Atomic Force Microscopy	21
November 12	<b>EXAM 3</b> (UV/Vis, molecular fluorescence, MS)	
November 17	Scanning Electron Microscopy	21
November 19	Scanning Electron Microscopy	21
November 24	Energy Dispersive X-ray Spectroscopy	21
November 26	<b>Thanksgiving Day, No Class</b>	
December 1	X-ray Photoelectron Spectroscopy	21
December 3	X-ray Photoelectron Spectroscopy /Course Evaluation	21
December 10	<b>FINAL EXAM</b> (STM, AFM, SEM, EDS, XPS, + appls.)	

<b>Exam Schedule:</b>	<b>Tuesday</b>	<b>Sept 22</b>	<b>Exam 1</b>	
	<b>Tuesday</b>	<b>Oct 20</b>	<b>Exam 2</b>	
	<b>Tuesday</b>	<b>Nov 12</b>	<b>Exam 3</b>	
	<b>Thursday</b>	<b>Dec 10</b>	<b>Final Exam</b>	<b>8:00 – 10:45 a.m.</b>

**Class Presentations:** Each student will present a PowerPoint talk to the class highlighting a research article published in a recent issue of *Analytical Chemistry*. The presentation sessions will be scheduled in November outside of class time. Details to follow.

## Course Policies

<b>Grading (credit) Criteria</b>	<b>Hour Exams – 20% each</b> <b>Class Presentation – 15%</b> <b>Final Exam – 25%</b>
<b>Extra Credit</b>	<b>There is no extra credit.</b>
<b>Class Attendance</b>	<b>Your attendance and class participation will have an impact on your final grade. Taking an active role in your learning will help you perform better.</b>
<b>Technical Support</b>	If you experience any problems with your UTD account you may send an email to: <a href="mailto:assist@utdallas.edu">assist@utdallas.edu</a> or call the UTD Computer Helpdesk at 972-883-2911.
<b>Student Conduct and Discipline</b>	<p>The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD printed publication, <i>A to Z Guide</i>, which is provided to all registered students each academic year.</p> <p>The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the <i>Rules and Regulations, Series 50000, Board of Regents, The University of Texas System</i>, and in Title V, Rules on Student Services and Activities of the university's <i>Handbook of Operating Procedures</i>. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391) and online at <a href="http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html">http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html</a></p> <p>A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.</p>
<b>Academic Integrity</b>	<p>The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.</p> <p>Scholastic Dishonesty, any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.</p> <p>Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.</p>
<b>Copyright Notice</b>	<p>The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials, including music and software. Copying, displaying, reproducing, or distributing copyrighted works may infringe the copyright owner's rights and such infringement is subject to appropriate disciplinary action as well as criminal penalties provided by federal law. Usage of such material is only appropriate when that usage constitutes "fair use"</p>

	<p>under the Copyright Act. As a UT Dallas student, you are required to follow the institution's copyright policy (Policy Memorandum 84-I.3-46). For more information about the fair use exemption, see <a href="http://www.utsystem.edu/ogc/intellectualproperty/copypol2.htm">http://www.utsystem.edu/ogc/intellectualproperty/copypol2.htm</a></p>
<b>Email Use</b>	<p>The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.</p>
<b>Withdrawal from Class</b>	<p>The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.</p>
<b>Student Grievance Procedures</b>	<p>Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's <i>Handbook of Operating Procedures</i>.</p> <p>In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.</p> <p>Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.</p>
<b>Incomplete Grades</b>	<p>As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of <b>F</b>.</p>
<b>Disability Services</b>	<p>The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30 a.m. to 6:30 p.m.; Tuesday and Wednesday, 8:30 a.m. to 7:30 p.m.; and Friday, 8:30 a.m. to 5:30 p.m.</p> <p>The contact information for the Office of Disability Services is:</p>

	<p>The University of Texas at Dallas, SU 22  PO Box 830688  Richardson, Texas 75083-0688  (972) 883-2098 (voice or TTY)  <a href="mailto:disabilityservice@utdallas.edu">disabilityservice@utdallas.edu</a></p> <p>If you anticipate issues related to the format or requirements of this course, please meet with the Coordinator of Disability Services. The Coordinator is available to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Services to notify them of your eligibility for reasonable accommodations. Disability Services can then plan how best to coordinate your accommodations.</p> <p>It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.</p>
<p><b>Religious Holy Days</b></p>	<p>The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.</p> <p>The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.</p> <p>If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.</p>

*These descriptions and timelines are subject to change at the discretion of the Professor.*