



<b>Course</b>	<b>CHEM 2401-003 / Quantitative Chemical Analysis (“QCA”)</b>
<b>Professor</b>	Paul Pantano, Ph.D. Analytical Chemistry (“Dr. P.”)
<b>Term</b>	Fall 2011
<b>Meetings</b>	Tuesdays & Thursdays / 4:00 pm – 7:45 pm

### Professor’s Contact Information

<b>Office Phone</b>	972-883-6226		
<b>Office Location</b>	Berkner Hall (BE) Room 3.506		
<b>Lab Location</b>	Science Learning Center (SLC) Room 3.220		
<b>Email Address</b>	pantano@utdallas.edu		
<b>Office Hours</b>	Thursdays / TBD		
<b>Other Info:</b>	<b><u>CHEM 2401 / Section 003 (Tuesdays &amp; Thursdays)</u></b>		
	FO 2.208	4:00 – 5:15 pm	<i><u>Note:</u> We read only ___@utdallas.edu</i>
	BE 3.102	5:00 – 7:00 pm	<i>Email; We do NOT read WebCT,</i>
	SLC 3.220	5:00 – 7:45 pm	<i>BlackBoard, or any other blogs.</i>
<b>Teaching Assistant</b>	<b>TA:</b> Peishen Huang	<b>Email Address:</b> peishen.huang@utdallas.edu	
	<b>Office Hour:</b> TBD	<b>Office Hour Location:</b> The GEMS Center	

### General Course Information

<b>Pre-requisites, Co-requisites, &amp; other restrictions</b>	CHEM 1312 and 1112 (General Chemistry II Lecture and Lab).
<b>Course Description</b>	A study of theories, applications, and calculations involved in methods of analysis, and the practice of volumetric, gravimetric, and spectrophotometric methods.
<b>Learning Outcomes</b>	<p><u>Objectives:</u> This course emphasizes the theory, applications, and calculations involved in the methods of analysis; and the theory and practice of volumetric, gravimetric, and spectrophotometric methods of analysis.</p> <p><u>Expected Learning Outcomes</u> Students should be able to:</p> <ol style="list-style-type: none"> <li>1. Solve stoichiometric and other analytical calculations</li> <li>2. Demonstrate their ability to carry out quantitative volumetric, photometric, and potentiometric determinations</li> <li>3. Explain the necessity for and use of error estimates and statistical methods</li> <li>4. Master the use of spreadsheets like Excel</li> <li>5. Operate at a level of good laboratory practice including safety and cleanliness</li> <li>6. Implement a professional-level lab notebook</li> <li>7. Construct professional-level lab reports</li> </ol>
<b>Required Materials</b>	<ul style="list-style-type: none"> <li>• “Quantitative Chemical Analysis, 7th ed.” by Daniel C. Harris www.whfreeman.com/qca7e</li> <li>• Two combination pad locks.</li> <li>• “Cold Springs Harbor Research Laboratory Notebook (NB)” This 8.5”x11” NB was chosen since it has <i>carbon-copy pages</i>.</li> </ul>
<b>Supplemental Material &amp; Info</b>	<ul style="list-style-type: none"> <li>• Other course materials may be recommended or required.</li> <li>• Gen Chem I and II TA Office Hours: visit the GEMS Center for schedules.</li> <li>• Tutors: See the Chem. Dept. AA (BE 2.312) for a list of private tutors.</li> </ul>

## Schedule & Academic Calendar

<u>Meeting</u>	<u>Date</u>	<u>Lecture and/or Activity</u>	<u>Lab Exp.#</u>	<u>Due Dates</u>
01 Th	8/25	Welcome to the World of Analytical Chemistry / Excel & Word / Lab Safety		
02 Tu	8/30	Linear Regression / Schedules / Grading	Drawers	
03 Th	9/01	Pipette Calibrations / Lab NoteBooks	Calibrate Pipettes	
Tu	9/06	QCA Holiday <No Labor>		
04 Th	9/08	Buret Calibration / Lab Reports	Calibrate Buret	
05 Tu	9/13	Experiment #5 / Statistics Lectures	Calibrate Buret	
06 Th	9/15	Acids, Bases, Buffers, Titrations	Exp. 5	Buret Graph
07 Tu	9/20	Acids, Bases, Buffers, Titrations	Exp. 5	
08 Th	9/22	No Lecture / Go Straight to Lab	Exp. 6	
09 Tu	9/27	More Titrations / Discuss Midterm	Exp. 6	Exp. 5
10 Th	9/29	Lab Reports / Midterm Problems	Exp. 6	
11 Tu	10/04	Acids, Bases, Buffers, Titrations	Exp. 8	
12 Th	10/06	Acids, Bases, Buffers, Titrations	Exp. 8	
13 Tu	10/11	The pH of High-Purity Water	pH meters	Exp. 6
14 Th	10/13	Acids, Bases, Buffers, Titrations	Exp. 7	
15 Tu	10/18	Electrochemistry	Exp. 7	Exp. 8
16 Th	10/20	Electrochemistry	Midterm Reviewage	
<b>17 Tu</b>	<b>10/25</b>	<b>Midterm Exam</b>		
18 Th	10/27	Potentiometric Titrations	Exp.15	
19 Tu	11/01	EDTA Titrations	Exp.15	Exp. 7
20 Th	11/03	EDTA Titrations	Analytical Sampling	
21 Tu	11/08	EDTA Titrations	Exp.11	
22 Th	11/10	Spectrophotometry and Calibrations	Exp.11	Exp.15
23 Tu	11/15	Spectrophotometry and Calibrations	Exp.19	
24 Th	11/17	Spectrophotometry and Calibrations	Exp.19	
25 Tu	11/22	Analytical Separations	Exp.26	Exp.11
Th	11/24	Dr. P's Birthday <No Labor>		
26 Tu	11/29	Analytical Separations	Exp.26	Exp.26
27 Th	12/01	Spectrophotometry and Calibrations	Exp.22	
28 Tu	12/06	Final Reviewage & Drawers	Exp.22	Exp.19
Tu	12/13			Exp.22
<b>12/09 – 12/14</b>		<b>Final Exam Week</b>	<b>See Page 4 of this Syllabus for details.</b>	

## Course Policies

	Harris Exp #	Title	PDF Page #
<b>Experiments</b>	5.	Statistical Evaluation of Acid-Base Indicators	15
	6.	Preparing Standard Acids and Bases	18
	8.	Analysis of a Mixture of Carbonate and Bicarbonate	22
	7.	Using a pH Electrode for an Acid-Base Titration	19
	15.	Potentiometric Halide Titration with Ag <sup>+</sup>	40
	11.	EDTA Titration of Ca <sup>2+</sup> and Mg <sup>2+</sup> in Natural Waters	29
	19.	Spectrophotometric Determination of Iron in Vitamin Tablets	48
	26.	Properties of an Ion-Exchange Resin	66
	22.	Spectrophotometric Analysis of a Mixture: Caffeine & Benzoic Acid	54
<b>Safety</b>	<p>IMPORTANT: In accordance with University and Chemistry Department safety rules, any time anyone (student, TA, instructor, or visitor) is in a lab, Z87-rated safety eyewear must be worn. The first violation in the semester will result in a warning and removal from the lab until the safety eyewear is in-place. The second violation in the semester will result in dismissal from that lab period with no extra time being allowed for make-up of the work scheduled for that lab period. Similar penalties will apply if any other safety rules are violated. In summary, all students are responsible for all information inside the undergraduate safety manual; it is located at:</p> <p><a href="http://www.utdallas.edu/nsm/chemistry/resources/safety.html">www.utdallas.edu/nsm/chemistry/resources/safety.html</a></p> <p>In addition, please refer to Dr.P.'s supplemental handout concerning optical and electrical safety issues.</p>		
<b>Lab Reports</b>	<p>Each student must prepare his or her own Lab Report for all 9 experiments based on the guidelines described in the Dr.P.'s Handout "Writing a Laboratory Report". The Lab Report for Exp. 5 will be evaluated but it will not count towards your grade. Each Lab Report will be worth 6 pts. Your 7 best Lab Reports will be summed for your Lab Report Score (42 pts. Total).</p> <p>Please refer to the Class Schedule/Calendar for all Lab Report Due Dates. Lab Reports are due at the beginning of class. Late Lab Reports will be penalized at a deduction rate of 21% per week.</p> <p>If a student does not perform an Experiment, the student will receive zero (0) points for the corresponding Lab Report. Make-up of lab periods/experiments missed (for valid medical or emergency reasons) will be attempted based on the constraints of the apparatus, SLC 3.220, and professor/TA availability.</p>		
<b>Lab NoteBooks</b>	<p>Each student must bring his or her Lab Notebook to Berkner every Tuesday and Thursday. Each student must keep his or her own neat and orderly Lab Notebook using ink. Please put your name and a date on every Notebook page you use. In addition, be sure to include data labels and units on all tables and graphs. Drawing chemical structures and balanced chemical reactions in your Notebook is highly encouraged. Additional tips for keeping a professional Notebook can be found on page 22 of your textbook. Your Notebook must be signed and dated by your TA (or professor) at the end of any day you spend working in the lab.</p>		
<b>Lab Technique</b>	<p>Each student will be evaluated with respect to their: adherence to good safety practices, laboratory technical skills, and laboratory etiquette/professionalism. The evaluations will be made by your TA (with the professor) at the end of each Experiment (9 pts. Total). If one does not attend, one cannot earn Technique Points.</p>		
<b>Quizzes</b>	<p>The majority of Quizzes will be administered after the Midterm Exam and before the Cumulative Final Exam. There will not be make-up quizzes; a missed quiz equates to zero (0) points. There will also be one Take-Home Statistics Quiz in September.</p>		
<b>Midterm Exam</b>	<p>The Midterm Exam (<b>Tuesday, October 25</b>) will focus on Equilibrium, Acids and Bases, pH and pKa Calculations, Buffers, and Titration Curves. There will not be a make-up Midterm Exam; a missed Midterm Exam equates to zero (0) pts. Students must take the Midterm corresponding to the Section they are enrolled in.</p>		

<b>Final Exam</b>	<p>The Final Exam is Cumulative because “Knowledge in Chemistry is Cumulative” –Professor Jung, UCLA, 1982. There will not be a make-up Final Exam; a missed Final Exam equates to 0 pts. Students must take the Final Exam corresponding to the Section they are enrolled in.</p> <p><b>Section-003 Final = Saturday, December 10, Room TBD, 2:00 – 4:50 p.m.</b></p>																																														
<b>Grading (credit) Criteria</b>	<p><b>Summary of Points:</b></p> <table><tr><td></td><td><u>Pts.</u></td></tr><tr><td>Lab Reports &amp; NoteBook Pages</td><td>42</td></tr><tr><td>Lab Technique</td><td>9</td></tr><tr><td>Special NoteBook Assignment (Exp.11)</td><td>4</td></tr><tr><td>Buret Calibration Graph</td><td>4</td></tr><tr><td>Quizzes</td><td>6</td></tr><tr><td>Midterm Exam</td><td>11</td></tr><tr><td>Cumulative Final</td><td><u>24</u></td></tr><tr><td>Total</td><td>100</td></tr></table> <p><i>Quizzes, the Midterm, and The Final will be different for each Section.</i></p> <p>Your final letter grade for the course will be determined using a scale such as the one below where the class average is set at the “B-/C+” border (e.g., 79.5 points):</p> <table><tr><td>A+</td><td>97 &amp; above</td><td>C</td><td>73-76</td></tr><tr><td>A</td><td>93-96</td><td>C-</td><td>70-72</td></tr><tr><td>A-</td><td>90-92</td><td>D+</td><td>67-69</td></tr><tr><td>B+</td><td>87-89</td><td>D</td><td>63-66</td></tr><tr><td>B</td><td>83-86</td><td>D-</td><td>60-62</td></tr><tr><td>B-</td><td>80-82</td><td>F</td><td>59 &amp; below</td></tr><tr><td>C+</td><td>77-79</td><td></td><td></td></tr></table> <p><i>Sections -001 &amp; -002 &amp; -003 are unique courses and are not graded together.</i></p>		<u>Pts.</u>	Lab Reports & NoteBook Pages	42	Lab Technique	9	Special NoteBook Assignment (Exp.11)	4	Buret Calibration Graph	4	Quizzes	6	Midterm Exam	11	Cumulative Final	<u>24</u>	Total	100	A+	97 & above	C	73-76	A	93-96	C-	70-72	A-	90-92	D+	67-69	B+	87-89	D	63-66	B	83-86	D-	60-62	B-	80-82	F	59 & below	C+	77-79		
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<b>Make-up Exams</b>	<i>vide supra</i>
<b>Extra Credit</b>	<b>None</b>
<b>Late Work</b>	<i>Late Lab Reports will not be accepted after the conclusion of “Final Exams Week”.</i>
<b>Special Assignments</b>	<b>Students are financially responsible for items checked-out of the stockroom.</b>
<b>Class Attendance and Citizenship</b>	<i>If a student is enrolled in Section-001, that student cannot attend Section-002 and/or Section-003 meetings (and vice versa). In addition, it is typical for CHEM-2401 activities to utilize the entire 225 minutes of class time such that students can not simultaneously enroll in other classes whose meeting days and times conflict with those of the CHEM 2401 section they are enrolled in.</i>
<b>Field Trip Policies Off-Campus Instruction &amp; Course Activities</b>	<p><i>Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at the website address <a href="http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm">http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm</a>. Additional information is available from the office of the school dean. Below is a description of any travel and/or risk-related activity associated with this course.</i></p> <p><b>None</b></p>
<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.

<p><b>Student Conduct and Discipline</b></p>	<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>
<p><b>Academic Integrity</b></p>	<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>
<p><b>Copyright Notice</b></p>	<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" 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>

<p><b>Email Use</b></p>	<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>
<p><b>Withdrawal from Class</b></p>	<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, the instructor(s) cannot drop or withdraw any student. The student must do the proper paperwork to ensure that he/she will not receive a final grade of "F" in a course if he/she chooses not to attend the class once he/she is enrolled.</p>
<p><b>Student Grievance Procedures</b></p>	<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>
<p><b>Incomplete Grades</b></p>	<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 <u>F</u>.</p>

<p><b>Disability Services</b></p>	<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:  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.***