Welcome to UNT!

As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of the students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation. UNT’s full Non-Discrimination Policy can be found in the UNT Policies section of the syllabus.

Course Description: CHEM 3451 Quantitative Analysis introduces students to the theory and practice of the quantitative aspects of the basic analytical chemistry. Topics to be discussed in lecture include solution preparation, statistical analysis, equilibrium calculations, titration analysis, electrochemistry, spectrophotometry, and introductory instrumental analysis.

(Notice: CHEM 3451 requires extensive calculations based on chemical equilibriums)

Course Objectives:

- Introduce Quantitative Analysis (QA) as a measurement science that bridges various scientific disciplines and applies to wide range of real-life applications.
- Enhance understanding of statistical analyses and quality assurance applications.
- Learn practical applications of various volumetric and gravimetric analyses.
- Introduction of modern instrumental analyses and its applications.

Instructor: Dr. Oliver Chyan,
Voice (940) 565-3463, Chemistry Building, room 156
E-mail: Chyan@unt.edu*

*Preferred Communication mode, please add “QA” to your email subject for efficient search, like “QA: my question about exam #1”.

Super TA: Joshua Caperton [JoshuaCaperton2@my.unt.edu]


Class Schedule: Tuesday/Thursday, 9:30 - 10:50 AM.
Will meet in person in CHEM room 106

Office Hours: (Tuesday & Thursday, 1:30 -3:00 PM) (by Zoom)

TA Office Hours: (by Zoom, distributed over week days, to be announced)
Attendance & Assigned Seating: Students are expected to attend class meetings regularly. You will be able to choose your preferred seating in room CHEM 106 during the first two classes. Once assigned, please seat in the same spot for the whole semester, for easy contact tracing and taking attendance. Please inform the professor and super TA if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

Exams: Three terms exams will be held on Sept 21, Oct. 12 & Nov 16 (Tuesdays, 9:30 – 10:50 AM, in-person Exam at CHEM room 106). Please plan accordingly. The grade assignments for each term exam is 25% grade each.

Final exam will be held on Dec 9, 8-10 AM. Final exam will be comprehensive (25% grade).

Missing Exam: Plan your schedule accordingly. If you must miss an exam, permission (with proper documentation) must be obtained in advance. Medical absence requires proper doctor’s statement.

Homework: Working the problems is very important to achieve better understanding of materials taught and good grade in the class. Extra credit (total 6 points) will be given for the completed homework submitted on time, see later section for more info.

Grading Scale:

<table>
<thead>
<tr>
<th>Final percent Average</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 - 100 %</td>
<td>A</td>
</tr>
<tr>
<td>80 - 89 %</td>
<td>B</td>
</tr>
<tr>
<td>70 - 79 %</td>
<td>C</td>
</tr>
<tr>
<td>60 - 69 %</td>
<td>D</td>
</tr>
<tr>
<td>Below 60 %</td>
<td>F</td>
</tr>
</tbody>
</table>

Note: I reserve the right to make changes/modifications of the syllabus if needed.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date (class #)</th>
<th>Topic</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug. 24 (#2)</td>
<td>Intro: Analytical Process &amp; Measurements (Ch 0,1) Tools of the Trade (Ch 2)</td>
<td>No Quant Lab this week</td>
</tr>
<tr>
<td>2</td>
<td>(#3, #4)</td>
<td>Experimental Error (Ch 3) Statistics (Ch 4)</td>
<td>Quant Lab starts August 30</td>
</tr>
<tr>
<td>3</td>
<td>(#5, #6)</td>
<td>Statistics (Ch 4) Quality Assurance &amp; Calibration (Ch 5)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(#7, #8)</td>
<td>Chemical Equilibrium (Ch 6)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sept 21 (#10)</td>
<td>(Exam #1) Ch. 1, 2, 3, 4 (Tuesday) Titration Begin (Ch 7)</td>
<td>25% grade</td>
</tr>
<tr>
<td>6</td>
<td>(#11, #12)</td>
<td>Activity &amp; Systematic Treatment (Ch 8)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(#13, #14)</td>
<td>Monoprotic Acid-Base Equilibria (Ch 9) Polyprotic Acid-Base Equilibria (Ch 10)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Oct 12 (#16)</td>
<td>(Exam #2) Ch. 5, 6, 7, 8, 9 (Tuesday) Acid-Base Titrations (Ch 11)</td>
<td>25% grade</td>
</tr>
<tr>
<td>9</td>
<td>(#17, #18)</td>
<td>EDTA Titrations (Ch.12)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>(#19, #20)</td>
<td>Fundamental of Electrochemistry (Ch.14)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>(#21, #22)</td>
<td>Electrodes &amp; Potentiometry (Ch.15) Redox Titrations (Ch.16)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(#23, #24)</td>
<td>Spectrophotometry + Spectrophotometers (Ch 18, 20).</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Nov 16 #26</td>
<td>(Exam #3) Ch. 10, 11, 12, 14, 15 (Tuesday) Atomic Spectroscopy (Ch 21)</td>
<td>25% grade</td>
</tr>
<tr>
<td>14</td>
<td>(#27)</td>
<td>Intro of Mass Spec &amp; Anal. Separation (Ch. 22, 23) Thanksgiving Break</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>(#28, #29)</td>
<td>Gas Chromatography, HPLC (Ch. 24-25)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dec. 9 Thursday</td>
<td>Final Exam (Comprehensive) (8-10 am)</td>
<td>25% grade</td>
</tr>
</tbody>
</table>
Tips on How to do well in CHEM 3451

1. **Team study** is a proven effective way to do well in this class. Find a safe way, make friends and work together now!

2. **Pre-view** (i.e. read ahead, preview lecture related materials on Canvas) the chapter(s) before attending the class, especially for new concepts like statistical analysis, etc.

3. **Get familiar with your textbook**! Look what is included in Appendixes D, E, F, G, H, I; *Solutions to Exercises (S1- ); *Answers to Problems (AN1- ).

4. To excel in Quantitative Analysis (Analytical Chemistry) requires 1) understanding the important concepts, 2) apply them to “hand-on” problem solving exercises that often requires calculations with chemical equilibrium concepts.

5. **Our lecturing time is rather limited. Both important concepts and selected examples will be covered** in the class. However, do not expect all types of questions tested will be covered exactly in the class. It is simply NOT possible to cover all types of calculations and problems within the limited class time. **It is your responsibility to work on all problems as described in 6 and 7 below.** We will be happy to provide as much help possible per requests during current COVID-19 situation.

6. **What will be tested from textbook?** Study chapter examples (covered the answer, verify your understanding of the problem, Do you know how to solve the problems?). Do the Test Yourself after each chapter examples. Practice on Exercises and verify the answers at the end of the book. Work on Assigned Problems and verify with answers from a solution manual. Mark/collect those problems you
have difficulty with for the quick review/practice right before the exam.

7. What will be tested other than textbook?
   a. Study “practicing quizzes” (will provide more info on Canvas)
   b. Lecture examples (take notes)

8. Most of exam problems (>70%) will be taken from 6 and 7. Exam questions may not copy exactly, but will be similar. Remaining 20-30% will be from lecture examples and other sources.

9. Practice before exam: Before the exam, make up a simulated exam (put in some of those marked problems you have difficulty earlier) and give yourself one hour and half on the simulated exam.

10. Helpful tip! After each exam, make sure you understand the relevant subjects you may mise and can really do the old exam problems. Make good correction notes will be handy for the comprehensive final exam, where some selected old exam questions with slight modification may be tested again.
Extra Credit for your work on assigned problems.

Extra credit: 0.5 point bonus for each completed homework handed in.

You can earn a total of 6.0 bonus points added directly to your final grade. [For example, final grade of 76(C) becomes 82(B)].

Submit your completed homework by Canvas for extra credit. No extra credit for late homework or direct copy from solution manual.

When: due each Saturday 5PM as scheduled below.

<table>
<thead>
<tr>
<th>Week of</th>
<th>Due date</th>
<th>Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd week</td>
<td>Sept. 4</td>
<td>Chapters 1, 2</td>
</tr>
<tr>
<td>3rd week</td>
<td>Sept. 11</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>4th week</td>
<td>Sept. 18</td>
<td>Chapter 4</td>
</tr>
<tr>
<td>5th week</td>
<td>Sept. 25</td>
<td>Chapter 5</td>
</tr>
<tr>
<td>6th week</td>
<td>Oct. 2</td>
<td>Chapter 6, 7</td>
</tr>
<tr>
<td>7th week</td>
<td>Oct. 9</td>
<td>Chapter 8,</td>
</tr>
<tr>
<td>8th week</td>
<td>Oct. 16</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>9th week</td>
<td>Oct. 23</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>10th week</td>
<td>Oct. 30</td>
<td>Chapter 11</td>
</tr>
<tr>
<td>11th week</td>
<td>Nov. 6</td>
<td>Chapter 12</td>
</tr>
<tr>
<td>12th week</td>
<td>Nov. 13</td>
<td>Chapter 14</td>
</tr>
<tr>
<td>13th week</td>
<td>Nov. 20</td>
<td>Chapter 15</td>
</tr>
</tbody>
</table>
# Assigned Homework Problems

*Quantitative Chemical Analysis*

by Daniel C. Harris *(9th edition)*

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### **Fundamental Skills**

<table>
<thead>
<tr>
<th>Ch.</th>
<th>Topic</th>
<th>Assigned Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The Analytical Process</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>Chemical Measurements</td>
<td>3-5 *(means 3 to 5; = 3, 4, 5), 13-15, 18, 20-27, 29-31, 33-37</td>
</tr>
<tr>
<td>2</td>
<td>Tools of the Trade</td>
<td>1, 2, 5, 6, 16-22, 24, 25, 28</td>
</tr>
<tr>
<td>3</td>
<td>Experimental Error</td>
<td>1-7, 9-18, 20-22</td>
</tr>
<tr>
<td>4</td>
<td>Statistics</td>
<td>1-3, 9, 11-15, 17-24, 26, 31, 35</td>
</tr>
<tr>
<td>5</td>
<td>QA and Calibration</td>
<td>1-8, 10, 12, 13, 18, 22, 23, 25, 26, 29, 30</td>
</tr>
<tr>
<td>6</td>
<td>Chemical Equilibrium</td>
<td>1-4, 6-8, 10, 14-16, 19-22, 28-30, 33-36, 38, 39, 44-52</td>
</tr>
</tbody>
</table>

### **Titrimetric Methods of Analysis**

<table>
<thead>
<tr>
<th>Ch.</th>
<th>Topic</th>
<th>Assigned Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Titration Begins</td>
<td>1-8, 10, 11, 13, 17, 19, 22, 26</td>
</tr>
<tr>
<td>8</td>
<td>Activity &amp; Systematic Treatment</td>
<td>1, 2, 4, 5, 7, 10, 11, 13, 16-20, 23, 25</td>
</tr>
<tr>
<td>9</td>
<td>Monophonic Acid-Base Equilibria</td>
<td>1-3, 5-8, 11-13, 18, 21-23, 26, 29, 30, 32, 34, 36, 39-40, 42, 43</td>
</tr>
<tr>
<td>10</td>
<td>Polyprotic Acid-Base Equilibria</td>
<td>3, 4, 6, 12-21, 24, 25, 29, 30, 38, 40, 41</td>
</tr>
<tr>
<td>11</td>
<td>Acid-Base Titrations</td>
<td>1-4, 6, 8, 12-14, 18, 19, 23, 25, 27, 29, 31, 36, 37, 42, 45, 49, 50, 58, 60, 62</td>
</tr>
<tr>
<td>12</td>
<td>EDTA Titrations</td>
<td>1-3, 6, 7, 14, 16, 23, 24, 27-29, 32-34, 36, 37</td>
</tr>
</tbody>
</table>

### **Electroanalytical Methods of Analysis**

<table>
<thead>
<tr>
<th>Ch.</th>
<th>Topic</th>
<th>Assigned Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Fundamentals of Electrochemistry</td>
<td>5-10, 12, 14-18, 21-23, 28-32, 37, 39, 40, 42, 43, 46, 49</td>
</tr>
<tr>
<td>15</td>
<td>Electrodes and Potentiometry</td>
<td>1, 2, 5, 8, 9, 12, 21, 22, 24, 25, 31-35</td>
</tr>
<tr>
<td>16</td>
<td>Redox Titrations</td>
<td>1-4, 7-11, 13, 14, 17-19, 22-27, 29, 30, 33</td>
</tr>
</tbody>
</table>
Technical Assistance

UNT IT Help Desk
Email:
helpdesk@unt.edu
Live Chat:
https://it.unt.edu/helpdesk/chatsupport
Phone: 940-565-2324
In Person: Sage Hall, Room 330
Hours and Availability: Visit https://it.unt.edu/helpdesk for up-to-date hours and availability

For additional support, visit Canvas Technical Help
(https://community.canvaslms.com/docs/DOC-10554-4212710328)

For additional support, visit Canvas Technical Help
(https://community.canvaslms.com/docs/DOC-10554-4212710328)

Canvas Technical Requirements (https://clear.unt.edu/supported-technologies/canvas/requirements)

Student Support Services

UNT provides mental health resources to students to help ensure there are numerous outlets to turn to that wholeheartedly care for and are there for students in need, regardless of the nature of an issue or its severity. Listed below are several resources on campus that can support your academic success and mental well-being:

- Student Health and Wellness Center (https://studentaffairs.unt.edu/student-health-and-wellness-center)
- Counseling and Testing Services (https://studentaffairs.unt.edu/counseling-and-testing-services)
- UNT Care Team (https://studentaffairs.unt.edu/care)
- Individual Counseling (https://studentaffairs.unt.edu/counseling-and-testing-services/services/individual-counseling)

Other student support services offered by UNT include

- Registrar (https://registrar.unt.edu/registration)
Course Policies

Face Coverings
UNT encourages everyone to wear a face covering when indoors, regardless of vaccination status, to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.

Attendance
Students are expected to attend class meetings regularly. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

If you are experiencing any symptoms of COVID-19 please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.
Course Materials for Remote Instruction if needed
Remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a webcam and microphone to participate in fully remote portions of the class. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn

UNT Policies

Academic Integrity Policy
Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

ADA Policy
UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one’s specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website (https://disability.unt.edu/).

Prohibition of Discrimination, Harassment, and Retaliation (Policy 16.004)
The University of North Texas (UNT) prohibits discrimination and harassment because of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law in its application and admission processes; educational programs and activities; employment policies, procedures, and processes; and university facilities. The University takes active measures to prevent such conduct and investigates and takes remedial action when appropriate.

Emergency Notification & Procedures
UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

Retention of Student Records
Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course
completion. Course work completed via the Canvas online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student’s records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University’s policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior
Student behavior that interferes with an instructor’s ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student’s conduct violated the Code of Student Conduct. The University’s expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. Visit UNT’s Code of Student Conduct (https://deanofstudents.unt.edu/conduct) to learn more.

Rules of Engagement
Rules of engagement refer to the way students are expected to interact with each other and with their instructors. Here are some general guidelines:

- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language on the basis of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law will not be tolerated.
- Treat your instructor and classmates with respect in any communication online or face-to-face, even when their opinion differs from your own.
- Ask for and use the correct name and pronouns for your instructor and classmates.
- Speak from personal experiences. Use “I” statements to share thoughts and feelings. Try not to speak on behalf of groups or other individual’s experiences.
- Use your critical thinking skills to challenge other people’s ideas, instead of attacking individuals.
- Avoid using all caps while communicating digitally. This may be interpreted as “YELLING!”
- Be cautious when using humor or sarcasm in emails or discussion posts as tone can be difficult to interpret digitally.
- Avoid using “text-talk” unless explicitly permitted by your instructor.
- Proofread and fact-check your sources.
- Keep in mind that online posts can be permanent, so think first before you type.

See these Engagement Guidelines (https://clear.unt.edu/online-communication-tips) for more information.
Access to Information - Eagle Connect
Students’ access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student’s Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail Eagle Connect (https://it.unt.edu/eagleconnect).

Student Evaluation Administration Dates
Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 [insert administration dates] of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website (http://spot.unt.edu/) or email spot@unt.edu.

Survivor Advocacy
UNT is committed to providing a safe learning environment free of all forms of sexual misconduct. Federal laws and UNT policies prohibit discrimination on the basis of sex as well as sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking and/or sexual assault, there are campus resources available to provide support and assistance. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-5652648.