Course Syllabus
Fall 2019
Chemistry 443/ CHE 575
Instrumental Analysis

Course Description: Spectrochemical and electrochemical methods of analysis.

Number of Credit Hours: 4 semester hours - 3 hours lecture

Course Prerequisites and Corequisites: Prerequisite: 231 and 337. Required lab fee.

Program Learning Outcomes:
1. The student will demonstrate knowledge of fundamental content in the basic areas of chemistry: Analytical, Biochemistry, Inorganic, Organic, and Physical.
2. The student will integrate knowledge with critical thinking to solve problems.

General Education Core Curriculum Objectives: There are no specific general education core curriculum objectives in this course. This course is not a general education core curriculum course.

Course Objective: To provide students with a more detailed explanation of the basic concepts, laws, and theories and to apply the knowledge to chemistry problem solving. The student will develop an appreciation for chemistry as it relates to the other disciplines. Furthermore, the student will recognize how chemistry provides solutions to contemporary, historical, technological, and societal issues. In addition, students will get experience in operating the following instruments: Fourier Transform Infrared Spectrometer, Atomic Absorption Spectrometer, Ultraviolet-Visible Spectrophotometer, Liquid Chromatograph, Gas Chromatograph, and Ion Chromatograph. Students will be taught to operate 400 MHz Nuclear Magnetic Resonance Spectrometer and a Gas Chromatograph-Mass Spectrometer. Students will be taught electrochemical techniques such as polarography, cyclic voltammetry, potentiometry, and chrono-amperometry.

Student Learning Outcomes: The student is expected to recognize and apply the fundamental and practical aspects of the following concepts and apply the concepts to problem solving:
- The principles of gas, liquid, ion, and gel permeation chromatography,
- The principles of UV-visible, infrared, nuclear magnetic resonance, Raman, and X-Ray spectroscopy,
- The concepts involved in atomic absorption spectroscopy,
- The fundamentals of how flame and graphite furnace atomic absorption spectroscopy are applied to analytical chemistry,
- The concepts used in electron spin resonance spectroscopy,
- The fundamentals of electrochemistry that relate to half-reactions, Voltaic cells, and electrolytic cells,
- The fundamentals of electrochemical analysis, including polarography, pulse polarography, voltammetry, potentiometry, coulometry, and amperometry.
Class Syllabus
Fall 2019
CHE 443-001/CHE 575
Instrumental Analysis

Instructor: Dr. Kefa K. Onchoke
Department: Chemistry & Biochemistry
e-mail: onchokkek@sfasu.edu
Office: NM-118
Phone: 936-468-2386
Office Hours: M 12-2; W 11-1; R 4 – 5 p.m.; F 4 - 5
Class meeting time and place: TR 8:00 am - 8:15 am.; Room: Math 130

   - Other articles and spectra handouts will be distributed in the course as required reading.

   - Quantitative Chemical Analysis, Daniel C Harris 7th Edition
   - Instrumental Methods of Analysis, 7th edn; Willard, Merritt, Dean, Settle

Specific Course Learning Objectives Include:
1. Demonstrate knowledge of sampling methods for all states of matter.
2. Assess sources of error in chemical and instrumental analysis and account for errors in data analysis.
3. Recognize interferences in chemical and instrumental analysis.
4. Comprehend the concept of and perform instrument and method calibration.
5. Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology.
6. Integrate a fundamental understanding of the underlying physics principles as they relate to specific instrumentation used for atomic, molecular, and mass spectrometry, magnetic resonance spectrometry and chromatography.
7. Understand and be able to apply the theory and operational principles of analytical instruments.
8. Distinguish between qualitative and quantitative measurements and be able to effectively compare and critically select methods for elemental and molecular analyses.

GRADING: There will be four exams each worth 100 points during the semester and one comprehensive final exam worth 100 points. No make-up exams will be given for any reason.

QUIZZES: Several quizzes will be given every week through the whole semester, each worth 10 points.

HOMEWORKS: Several announced homeworks will be given through the whole semester, each worth 10 points. Homeworks will be turned in at times announced in class each week.
Grades will be assigned according to the results from 4 exams, quizzes, homeworks, and the final examination using the following point distributions:

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Exam I (Th. 9/19)</td>
<td>100 pts</td>
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<tr>
<td>Exam II Th. Oct., 10</td>
<td>100 pts</td>
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<tr>
<td>Exam III (Th. Nov. 14)</td>
<td>100 pts</td>
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<tr>
<td>Comprehensive make-up (Th., Dec. 5)</td>
<td>100 pts</td>
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<tr>
<td>Final Exam (Comprehensive ACS Final); Thur., Dec. 12</td>
<td>200 pts</td>
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<tr>
<td>Quizzes (50 pts) + Homeworks (50 pts)</td>
<td>100 pts</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>600 pts</strong></td>
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**Grading Scale (percentage of 400 points):**

- A: 100-90%
- B: 89-80%
- C: 79-70%
- D: 69-60%
- F: below 60%

[A ≥ 540 pts; B ≥ 480; C ≥ 420; D ≥ 360; F < 359].

**Final Exam** – There will be a final comprehensive ACS multiple choice exam, worth 200 pts, given during class.

**Comprehensive Make-Up:** Will be done on Dec. 5/2019.

**Note:** The attached class schedule is tentative (see Page 4). I will attempt to follow it as closely as possible with respect to lecture topics and exam material. However, any changes as to the exact material to be covered in lecture and each exam will be announced in class. It is therefore important for you to attend class regularly.

**MAKE-UP POLICY:** There will be no make-up exams, quizzes, or labs.

**ATTENDANCE POLICY:** Attendance of class is mandatory. A total of two unexcused absences will result in the student being dropped from the class with a grade of "F".

**ACADEMIC INTEGRITY (A-9.1):** Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

**Definition of Academic Dishonesty**

Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one’s own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one’s paper without giving the author due credit.

Please read the complete policy at [http://www.sfasu.edu/policies/academic_integrity.asp](http://www.sfasu.edu/policies/academic_integrity.asp)

Any student found cheating will be subject to the penalties as stated in the Student Code of Conduct handbook; including but not limited to a score of zero on exam, expulsion from the class or expulsion from the University.
### COURSE CALENDER & CONTENT:

Material will be covered in the following section order with approximate class time. Exam schedule is tentative.

<table>
<thead>
<tr>
<th>Chapter/Dates</th>
<th>Topics and Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 6 (8/27)</td>
<td>Introduction to Instrumental Analysis and Spectrometric Methods (Chapter 6)</td>
</tr>
<tr>
<td>7 (8/30)</td>
<td>Components of Optical Instruments (Chapter 7)</td>
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<tr>
<td>8 (9/3 &amp; 9/6)</td>
<td>Atomic Spectroscopy (Chapter 8)</td>
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<tr>
<td>9 (9/10 &amp; 9/12)</td>
<td>Atomic Absorption Spectroscopy (Chapter 9)</td>
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<tr>
<td>10, 13 (9/11-17)</td>
<td>Atomic Emission Spectroscopy (Chapter 10) &amp; Introduction to Ultraviolet/Visible Molecular Absorption Spectroscopy (Chapter 13)</td>
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<tr>
<td>Exam 1 (9/19)</td>
<td>Exam 1, Thursday 6.00 - 9 pm</td>
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<tr>
<td>13 (9/17)</td>
<td>Introduction to Ultraviolet/Visible Molecular Absorption Spectroscopy (Chapter 13)</td>
</tr>
<tr>
<td>14 (9/19 – 9/24)</td>
<td>Applications of UV-Vis Spectroscopy (Chapter 14)</td>
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<tr>
<td>16,17 (9/26 –10/1)</td>
<td>Infrared absorption spectroscopy (Chapter 16 &amp; 17)</td>
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<tr>
<td>19 (10/3-10/10)</td>
<td>NMR Spectroscopy (Chapter 19)</td>
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<tr>
<td>Exam 2 (Oct. 10)</td>
<td>Exam 2, Thursday, 6.00 - 9 pm</td>
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<tr>
<td>20 (10/11-10/15)</td>
<td>Mass Spectrometry (Chapter 20)</td>
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<tr>
<td>26,27 (10/17-11/24)</td>
<td>Introduction to Chromatography, Gas Chromatography (Chapter 26 &amp; 27)</td>
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<tr>
<td>28 (10/27-11/7)</td>
<td>Liquid Chromatography (Chapter 28)</td>
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<tr>
<td>Exam 3 (11/14)</td>
<td>Exam 3 Thursday, 6.00 - 9 pm</td>
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<tr>
<td>22 (11/14)</td>
<td>Introduction to Electrochemical Methods (Chapter 22)</td>
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<tr>
<td>23 (11/10-16)</td>
<td>Potentiometric Methods (Chapter 23)</td>
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<tr>
<td>11/17-11/22</td>
<td>Potentiometric Methods and Voltammetry (Chapter 23 &amp; 25)</td>
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<tr>
<td>11/23-12/2</td>
<td>Thanksgiving break for students and faculty - no classes, classes resume on 12/22</td>
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<tr>
<td>12/2 – 12/7</td>
<td>Potentiometric Methods and Voltammetry (Chapter 23 &amp; 25) &amp; Reviews</td>
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<tr>
<td>12/2-12/6</td>
<td>Potentiometric Methods and Voltammetry (Chapter 23 &amp; 25) &amp; Reviews</td>
</tr>
<tr>
<td>Exam 4/Dec. 3</td>
<td>Comprehensive Make-up</td>
</tr>
<tr>
<td>FINAL EXAM</td>
<td>Thursday, Dec. 12, 8a.m.- 10:00 a.m.</td>
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**NOTE:** This course schedule is tentative

**WITHHELD GRADES** **SEMESTER GRADES POLICY (A-54):**

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will
automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.
The circumstances precipitating the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

**STUDENTS WITH DISABILITIES:** To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

**SEMESTER WITHDRAWALS:** Last day to withdraw from the course without obtaining WP or WF grade is October 23.

**CLASSROOM BEHAVIOR POLICY:** To ensure a classroom environment conducive to learning, any forms of classroom disruptions will not be tolerated (examples but not limited to – talking, use of cell phones/beepers, sleeping, reading other material, eating/drinking). Students who violate these rules will be asked to leave. Repeat offenders will be subject to disciplinary action in accordance with University policies as described in the Code of Student Conduct. All necessary/required parts of the day’s experiment must be done prior to class.

**STATEMENTS OF CONCERN:**
1) Students are expected to be prepared for every class, which includes having the following items done before they arrive for class:
   a) read the chapter/material to be covered before class.
   b) Take good notes during class.
   c) No lateness or tardiness will be tolerated. Anyone coming late will not be allowed to class.
2) Violation of any class regulations will result in one warning being issued. If a second infraction occurs, the student will be asked to leave the class for that day.

**Strategies for Succeeding in Chemistry 443/575:**
1. Attend every lecture because the topics covered in this course build on each other.
2. Prior to class, read the chapter which will be covered in lecture.
3. Review your lecture notes after each class. Correct obvious errors and note topics which require further study or clarification.
4. Work on homework problems until you can solve them without any help or guidance.
5. Spend the necessary amount of time studying chemistry. The rule of thumb for succeeding in
6. **Chemistry is three hours of study for every hour of lecture.** This means that you should plan to study Chemistry for a minimum of nine hours each week.
7. Don’t procrastinate. The concepts take time to sink in, and you may have to practice these exercises over a period of many days in order to master the necessary skills.
8. Form a study group. This is your first avenue for getting help. Be able to communicate with each other on short notice, not just before class.