CHEM 3472-001 (Fall 2016)
Instrumental Analysis

Term: Fall 2016
Lecture: M-W 12:00-1:15 PM in **SLC 2.304**
Lab: M-W 1:15-3:45PM in **BE2.330, BE2.332**

Course description:
The goal of this course is to provide you with practical experiences of using modern analytical instrumentation including ultraviolet, visible, fluorescence, atomic and mass spectroscopy, electrochemistry, surface and microanalysis, and chromatography. Emphasis will be placed upon fundamental principles, data acquisition and analysis, and report writing.

Learning Objectives:

Core Objective 1: This course is designed to prepare students for employment and/or further work in chemistry by providing instruction in methods of instrumental analysis, including chromatographic, spectroscopic, and statistical techniques.

Core Objective 2: This course is designed to help students gain a deep understanding of fundamental principles used in the design of a variety of analytic instrument through hand-on experiences.

Core Objective 3: Students will also learn how to keep a laboratory notebook with an emphasis on communicating procedures, observations and data in such a way that results could be duplicated. In addition, students will document data and observations in laboratory reports, develop skills for critical thinking, analyzing the data and drawing conclusions.

Core Objective 4: Students will also develop team-work attitudes including the ability to consider different points of view and to work effectively with others to support a shared purpose or goal.

Instructor:
Dr. Jie Zheng
Office: NSERL 2.412
Phone: 972-883-5768
Email: jiezheng@utdallas.edu
Office hours: Tuesday 2:00-3:00pm or by appointment
Other information: Use of standard computational programs, such as Excel, will be required. Contact the instructor early in the course if assistance is needed.
Please bring your Comet Card with you to enter NSERL

Teaching Assistants:
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Prerequisite:
Prerequisite: CHEM 2401 Quantitative Analysis

Required/Recommended Texts Books & Materials:
(1) **Principle of Instrumental Analysis**, 6th edition (2007) Skoog, Holler and Crouch
(2) **Undergraduate Instrumental Analysis**, 7th edition, James W. Robinson, E.M. Skelly Frame, G.M. Frame II
(3) Lab Book: "Roaring Springs Composition Book", Quad. Rules 5 to 1", Bar Code 71072 77255, available in UTD Bookstore or other location.

Homework and Quizzes:

There will be homework and quizzes throughout this class with emphasis on the different topics taught in class. Homework and Quizzes are designed to help students understand the fundamental principles of various analytical techniques and prepare students for the upcoming exams. There are 5 quizzes totals, and no makeup quizzes. The quizzes will be graded. The date will be announced in the class.

Exams:
Two 1-hour exams and one three-hour final exam will be given throughout the course. The dates of these exams will be confirmed in class and on the eLearning.

Lab Safety:
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. Please visit http://www.utdallas.edu/chemistry/resources/safety.html for detailed safety rules.

In addition, please refer to the supplemental handout concerning optical and electrical safety issues.

Notebooks:
You are expected to record all data in your notebooks. Each student must keep his or her own neat and orderly lab notebook using pen. You must bring your lab notebook during the lab periods. Please put your name and a date on every 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. **Your notebook must be signed and dated by your TA at the end of any day you are working in the lab. There are no make-up labs**.

We will evaluate each student during the lab period. Each student will be evaluated with respect to their lab performance: adherence to good safety practices, laboratory technical skills, and laboratory etiquette/professionalism.

Reports:
Each student will collect data with a laboratory partner.
Each student will complete their own Lab Report for all **10 experiments** based on the guidelines given in the lecture. The laboratory reports must contain own graphs, own calculations, and own answers to assigned questions. All ten experiments will count towards your grade. Data sheets need to be attached to the final lab report. . **An electronic copy should be turned in to the Turnitin box in eLearning.**

The lab report completed the previous week are **due at 5 pm on Friday** of that week; the report should be graded over the weekend and returned to you on the following Tuesday. This procedure allows students at least eight days to complete a lab report.

Lab reports will be collected in a designated box on the second floor of Berkner building (**BE 3.502**).
No emailed submissions. NOTE: All lab reports received after 5 PM will be penalized at a deduction rate of 5%. Each additional business day a lab report is late will be penalized at an additional deduction rate of 10% per day. Lab reports submitted later than 2 weeks after due date equal a zero (0).

If a student does not perform an Experiment, the student will receive zero points for the corresponding Lab Report. **NO** Make-up of lab periods/experiments.

- **If you wish to submit an exam or lab report for a re-grade because you believe you lost points unfairly, you must do so within the next class meeting of receiving your quiz, exam, or lab report.**
- **Your entire exam and/or lab report will be re-graded, not just the particular problem you pointed out.**
- **Quizzes will not be re-grade**

Lectures:
In order for you to conceptionally understand how the instruments work it is important that you attend class and read the assigned material in your text. It is impossible to cover all of the concepts before you begin your experiments. Therefore you may have to read ahead in the text and ask for the help before beginning an experiments whose concepts have not yet been covered in class. In general lecture notes will not be posted. Therefore it is important that you take notes in class.

Integrity:
Plagiarism includes copying material from printed sources including the world wide web. To make it your own you must read and understand the material and report the concepts in your own words. Copying figures from the web is OK as long as it is not covered by copyright and as long as your reference is cited. **Do not give your lab report to anyone, either before or after it is graded.** Should your words appear in another student's report you, along with the student who benefited, will be guilty of collusion. **Those students who either innocently or knowingly participate in collusion or plagiarism will be turned into UTD judicial**. **Lab reports may be**

routinely screened with turnitin software. Reports with Turnitin scores of more than 35% will be given a grade of zero.

Grading:
Your course grade will be determined as follows:
Two in-class exams (20%); Final Exam (20%); Quizzes (10%), Lab reports (50%)
Final letter grade will be assigned based on the following scale: A+(97-100), A(92-96), A-(88-91), B+(85-87), B(82-84), B-(79-81), C+(76-78), C(73-75), C-(69-72), D+(65-68), D(60-64), F(0-59).

Appendix A

LECTURE, LABORATORY, AND EXAM SCHEDULE

(The dates, order of presentation and topical coverage are subject to change.

Date		Lecture Topic
M	8/22	Class Organization, course overview
W	8/24	Statistics I
M	8/29	Statistics II
W	8/31	Statistics III
M	9/05	NO CLASS
W	9/07	Spectroscopy I – Introduction
M	9/12	Spectroscopy II – Components of an Optical Spectrometer
W	9/14	Spectroscopy II – Components of an Optical Spectrometer (continue)
M	9/19	Spectroscopy III – Atomic absorption and Emission
W	9/21	Spectroscopy IV – Molecular Absorption
M	9/26	Spectroscopy V – Molecular Emission
W	9/28	Spectroscopy VI – Infrared Absorption
M	10/03	Spectroscopy VII – Raman Spectroscopy
W	10/05	Review Exam I

M	**10/10**	**Exam I**
W	10/12	Go over Exam I
M	10/17	Chromatography I - Theory
W	10/19	Chromatography II – GC/HPLC
M	10/24	Chromatography IV - Capillary Electrophoresis
W	10/26	Mass Spectrometry I
M	10/31	Mass Spectrometry II
W	11/02	Electrochemical analysis (I)
M	11/07	Electrochemical analysis (II)
W	11/09	Nuclear Magnetic Resonance Spectroscopy I
M	11/14	Review Exam II
W	11/16	**Exam II**

11/21-11/26 Fall break and Thanksgiving break

M	11/28	Go over exam II
W	11/30	Dynamic Light Scattering
M	12/05	Special Topic/Presentation
W	12/07	Review Final Exam

Final Exam: TBA

Appendix B

Laboratory Modules:

Number Title

L1 Multicomponent UV Analysis of α- and β-Acids in Hops **(UV)**

L2 Determination of Mn in vitamin tablet using Atomic Absorbance **(AA)**

L3 Determination of quinine in tonic water using fluorescence spectroscopy **(Fluorescence)**

L4 Use of Fluorescent Plate Reader/Sampling of Heterogeneous Solids **(Plates)**

L5 Raman Forensics Lab **(Raman)**

L6 Optimizing Separation Using An HPLC Simulation Routine **(HPLC)**

L7 Using Infrared Spectroscopy to Investigate Protein Structure **(FTIR)**

L8 Analysis of Excedrin Migraine Tables by Proton NMR **(NMR)**

L9 Investigation of Imposter Perfumes Using GC–MS **(GC-MS)**

L10 ICP-MS analysis of heavy metals in hair samples **(ICP-MS)**

Lab/Alternate Activity Schedule
(Assignments for Lab schedule will be made approximately one week prior to the start of labs. Students will work in pairs. 10 lab modules will be available; each module requires one week of lab work (two lab periods).

Date		**Activity**	**Report Due**
M	09/12/16	Lab #1	
W	09/14/16	Lab #1	
T	9/19/16	Lab #2	
R	9/21/16	Lab #2	
F	9/23/16		Lab Report #1
M	9/26/16	Lab #3	
W	9/28/16	Lab #3	
F	9/30/16		Lab Report #2
M	10/3/16	Lab #4	
W	10/5/16	Lab #4	
F	10/7/16		Lab Report #3

M	10/10/16	Lab #5	
W	10/12/16	Lab #5	
F	10/14/16		Lab Report #4
M	10/17/16	Lab #6	
W	10/19/16	Lab #6	
F	11/21/16		Lab Report #5
M	10/24/16	Lab #7	
W	10/26/16	Lab #7	
F	10/28/16		Lab Report #6
M	10/31/16	Lab #8	
W	11/2/16	Lab #8	
F	11/4/16		Lab Report#7
M	11/7/16	Lab #9	
W	11/9/16	Lab #9	
F	11/11/16		Lab Report #8
M	11/14/16	Lab #10	
W	11/16/16	Lab #10	
F	11/18/2016		Lab Report #9
M	11/21/16	No Lab	
W	11/23/16	No Lab	
M	11/28/16		Lab Report #10

Appendix C: Chemistry 3472 Lab Expectations

You will be expected to turn in your lab report and copies of lab notebook You will be expected to show your lab book containing a brief introduction and detailed procedure for your lab each week before you enter the lab. You will not be able to enter the lab until this is complete.

Lab Report

A typed report and an electronic report is expected to be turned in containing the following:

Title, date, partner's name (your name and date on each page)
Abstract
Introduction – This should detail the theory and function of the instrument.
Experimental methods/Procedure - Include serial numbers of the instrument used.
Results and Calculations
Discussion
References

Lab Book page copies attached as an appendix

The lab book should contain an intro, hand written procedure, experimental data, calculations, and brief conclusion. It should also have a complete Table of Contents
You should only write in your lab notebook. **DO NOT** write on loose paper and transfer to you notebook. Your lab notebook should be signed by the TA or the instructor before you leave for the day.

- You will lose points if you do not clean up. **Before you leave the lab, clean around the balances, under the hood and return chemicals from where you got them.** Make sure to collect all your glassware.

Safety

All safety regulations will be strictly followed. No students will be allowed into the lab without the correct lab attire which requires goggles, pants, closed toe shoes, and sleeved shirts.

Lab Drawers

Each week you will be expected to come to lab prepared for your specific lab module. You will rotate drawers depending on which lab module you are doing.
Those students doing HPLC-Sim do not have drawers.

Please note: Adjustments may be made by the instructor based on class ability.

Appendix D: Course policies

Make-up Exams	**None**
Extra Credit	**None**
Late Work	**Lab report submitted two weeks after the due date will receive a**

	zero.
Special Assignments	**Students are financially responsible for items checked out.**
Class Attendance	**Highest encouraged**
Classroom Citizenship	**Highest level is expected**
Field Trip Policies	**No off campus trips**
Student Conduct and Discipline	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 publication, *A to Z Guide*, which is provided to all registered students each academic year. 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 *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. 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). 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.
Academic Integrity	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. Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the

	following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings. 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.
Email Use	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.
Withdrawal from Class	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.
Student Grievance Procedures	Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*. 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 deal 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. 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.
Incomplete Grades	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 **F**.
Disability Services	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. 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) 883-2108 (voice or TTY) Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

	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.
Religious Holy Days	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. 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. 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.
Off-Campus Instruction and Course Activities	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 http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm. Additional information is available from the office of the school dean.

Comet Creed:
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

Appendix E: UT Dallas Syllabus Policies and Procedures:

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.